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EDITORIAL

NECESSITY FOR A CHAIR OF TRAUMATIC SURGERY IN ALL MEDICAL SCHOOLS

AS one of the members of the editorial board, I have been requested by our Editor to give an expression of my ideas on this subject.

I will attempt, as clearly as possible, to cover the subject without becoming personal. Undoubtedly some of my statements will not be acceptable to everybody, but I am only expressing my viewpoint of the situation and after considerable discussion with others specializing along the same lines.

Thirty-three years ago I started practicing Industrial Surgery, long before occupational diseases were ever considered; even compensation laws in the different States were not established, and everything handled was under Common Law practice. Our education in school along industrial lines, now called Traumatic Surgery was extremely limited and inadequate. Our courses in handling fractures, nerve injuries and dislocations were so inadequate that we had to establish an office and attempt to do this work as best we could, in many instances I am sorry to say, at the expense of the patient. Our solutions for hands and instruments, at a fair guess, consisted of twenty drops of carbolic acid to a pan of water; steam sterilization was in its infancy.

There was no surgical manual to follow, nor were there any books on the subject. In handling any traumatic case, we had to use our judgment according to our individual initiative. *X*-rays were not in use; we had to decide by manipulation, sense of touch, plus plenty of common sense, whether we were producing a good result or not.

In retrospect, some of the results we obtained are surprising, though some of the bad ones were somewhat deplorable.

The few of us who persisted in this work were forced to develop new ways to help humanity, despite adverse

criticism by the Medical Society. More than once in those early days, I was haled before the Ethical Relations Committee of my city, for apparently fracturing in various ways the "Oath of Aesculapius." This Committee composed of men who were supposed to be my superiors, at one time consisted of a gynecologist and two general practitioners. In fact, I was regarded as a rank outsider only to be tolerated, possessing very suspicious principles and devoid of sentiment or character.

Since then there has been a reversal of the entire situation, which I have watched with considerable amusement and interest.

Corporations today have their private medical set up and employ the best men they can get and the best men are only too glad to accept the positions offered. The insurance companies are doing likewise. The American College of Surgeons has accepted Traumatic Surgery as a separate section.

The most interesting clinics at present are Traumatic Clinics and some of the finest men I know throughout the country are willing to be found at these meetings. In fact, many of them *now represent* these companies in one capacity or another. But beyond that we have not progressed. To the best of my knowledge there is not a recognized Medical School in the country that is teaching, or has a Chair of Traumatic Surgery filled by a man who through years of hard knocks and training along this particular line, teaches the subject.

I do not mean to infer that the students do not receive some lectures on the handling of fractures, etc., "Yes," they admit to me in the different hospitals of which I am on the Attending Staff, they get "something" as they express it, but admit it is very scanty. When I see a Taylor spine brace being put upside down on a man's back, it is just too bad and in my estimation does not speak well for the Traumatic Curriculum of that institution.

Likewise, Thomas splints, abduction splints, in fact many things along this line are not taught today and in my estimation it is time the schools recognized this situation and improved it.

In view of my rather definite statements in this respect, I made inquiries from three recent graduates of three recognized Class A medical schools and the answers were the same, "a decidedly inadequate traumatic course" and some of their criticisms are far from complimentary.

"Traumatic Surgery" *can not be taught by a general practitioner* but should be taught by one who has been, and is devoting his entire time to the subject, and recognized as such, and can convey his knowledge to his listeners.

Some five years ago a meeting was called by Dr. Franklin Martin, of the American College of Surgeons, which ten or fifteen experienced traumatic surgeons were asked to attend. The purpose was to determine wherein the trouble lay for the young doctor of that period, the schools or elsewhere.

I was called first; I expressed myself very bluntly in regard to the lack of teaching of Traumatic Surgery, as well as the Compensation Law, which should come under Medical Jurisprudence, and cited some very glaring examples. I was supported by every Traumatic Surgeon in the room.

It was a very disconcerting situation to the listeners, to say the least. The deans of three Medical Universities were present. The question was put to one of them; the answer, "Well, you know it is pretty hard to teach an old dog new tricks," was about the weakest explanation I have ever heard.

We older men have had to improve our knowledge of Traumatic Surgery in any way possible, some of us going abroad to see how the other fellows over there do it; this I have done repeatedly.

After visiting Böhler, in Vienna, some ten years ago, I was the first man in Chicago to advocate his methods. I was unpleasantly criticized but today his methods are being used all over the city and

to some extent in many other cities but not in the Medical Schools.

A man who teaches this subject in any of the larger medical universities should by virtue of his years of hard work, real experience, a proved reputation and ability, be the logical one to be appointed, providing it can be done; but with the local situation of competition, jealousy, lack of cooperation and understanding in each university, I question the success of any Dean of any University, unless he has the courage of his convictions.

Dr. Hart E. Fisher, Chief Surgeon of the Chicago Rapid Transit Company, published in the June, 1935 issue of "Industrial Medicine," an excellent teaching set up which could be adopted.

The University that establishes a real Chair of this nature, appointing a well trained Traumatic Surgeon of years of experience, will be surprised at the number of students who will attend that University. I say this because I am being approached continuously by young men asking what University gives a good Traumatic course. Likewise, it might interest the same Universities that practicing physicians who are located close to automobile or traffic highways, are having to meet the demands of more intelligent handling of bodily injuries and they, too, are trying to find places to go for such a course.

In my opinion it is time the Medical Schools woke up to the seriousness of this situation and the present lack of teaching facilities in Traumatic Surgery.

None of us are going to live forever and our places should be filled by capable and competently trained men who will follow us.

There is no doubt that any of us older men in the larger cities of our country, capable of teaching this subject, would be willing to do so provided we were not hampered by the petty politics or iconoclasm of the universities.

C. R. G. Forrester.

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UNILATERAL AND BILATERAL HERNIA

COMPARATIVE STUDY OF POSTOPERATIVE COMPLICATIONS AND FACTORS CONCERNED*

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THIS study was undertaken primarily for the purpose of determining whether there was any increased risk to the patient in the performance of bilateral over unilateral inguinal herniotomy. It resolved into an analysis of the postoperative complications and an attempt to ascertain the etiologic factors concerned. It was felt that information might be obtained which would aid in determining the value of thyroid extract as a prophylactic agent against embolism.

The total number of cases studied was 1066, comprising a consecutive series of 522 bilateral and 544 unilateral herniotomies. Of the total number of patients, only 71, or 6.6 per cent, were females.

Although various types of surgical procedures are employed in the treatment of inguinal hernias they are sufficiently standardized to give a reasonable basis for comparison, and it can be said that there is approximately twice as much surgical trauma, and the duration of operation and anesthesia is approximately twice as long in bilateral herniotomy as in unilateral herniotomy.

Right inguinal hernia occurs more frequently than left inguinal hernia, but there is no significant difference between the two in the risk of operative treatment, as far as complications are concerned. An interesting point was noted that, regardless of the side on which operation had been performed, phlebitis occurred much more frequently in the left leg.

We shall first concern ourselves with those complications that could be of embolic origin or etiologically be referred to the vascular system. When direct proof of this was lacking the embolic nature of the complication has been assumed on clinical diagnosis, in many instances supplemented by the roentgenologic findings. Phlebitis has been diagnosed on the criteria advocated by Brown: tenderness along the course of the vein, edema, and a constitutional reaction.

TABLE 1
COMPARATIVE STUDY OF COMPLICATIONS FOLLOWING HERNIOTOMY

Complications (Group A)	Bilateral	Unilateral
Pneumonia	24*	9†
Sudden death	3	0
Pleurisy	3	2
Embolic pneumonia and phlebitis	2	2
Cerebral embolism and phlebitis	1	0
Phlebitis	11	10
Total	44	23

* In 10 of these cases pneumonia was of embolic origin; in 7 others proof of such origin was not obtained.
† In 4 of these cases pneumonia was of embolic origin; in 3 others proof of this was not obtained.

In Table 1, Group A, it will be seen that there were 24 cases of pneumonia in the bilateral group of 522 operations and 9 in the unilateral group of 544, which is approximately three times as many for bilateral as for unilateral herniotomy. Clinical evidence showed that in 10 cases in the bilateral group and in 4 in the unilateral group pneumonia began with infarction. In some instances the roentgenologic

* Read before the meeting of the Nevada State Medical Association, Elko, Nevada, October 25 to 26, 1935.

findings corroborated the clinical findings. Roentgenograms of the thorax of a patient who is in bed are not wholly satisfactory and the clinical evidence is more reliable in the early case of pneumonia. Although it is probable that the complication of pleurisy is to be explained on another basis, it is possible that it may be embolic, resulting from an infarct near the outer surface of the lung.

There were 11 cases of frank phlebitis in the bilateral group of herniotomies and 10 in the unilateral group. In 2 cases in each group phlebitis was associated with an unquestioned embolic pneumonia and in one case in the bilateral group with cerebral embolism. Although there were no sudden deaths from embolism in cases in which single inguinal hernias were repaired, there were 3 in cases in which bilateral herniotomy was performed.

Altogether there were approximately twice as many complications of proved vascular origin in the bilateral group as in the unilateral group. Those complications which did not seem to be connected with a faulty vascular system were grouped under the heading of miscellaneous. Some of these complications were serious but most are better classified as annoying. Principal among these were epididymitis, orchitis, cystitis, prostatitis, parotitis and infected wounds. There were about 12 of these various complications in each group.

There is a sound dictum in surgery that no patient should be advised to undergo operation, no matter how simple or serious unless, in the estimation of the surgeon, the benefits to be derived outweigh the risk involved. A review of these cases discloses that in a great many instances in which the risk seemed to be increased, complication did not ensue, most probably because of increased precautions being taken, "forewarned being forearmed." While complications did develop in some cases in which the risk had seemed to be increased, the majority of these complications developed in cases in which with present knowledge, it was impossible to predict the degree of danger from operation.

Is sex an index? McCartney, as well as others, has stated that the female is more subject to postoperative vascular accidents than the male. This seemed to be substantiated, although not markedly so, in our series.

Excluding one patient who was in the eighth decade of life, there was no great difference in the age distribution for each respective group. The patient's weight as a factor in the risk in the unilateral group seemed to be of little significance, but in the bilateral group there was a definite increase in the percentage of risk for patients weighing more than 190 pounds (86.2 kg.). This is not new, however, as obesity has long been recognized as increasing the hazard in any type of case.

We will not take the time here to review those conditions which obviously may complicate any surgical procedure, but rather, will pass to a consideration of possible factors which may be encountered at operation:

Table II
COMPARATIVE STUDY OF TYPES OF ANESTHESIA

Anesthesia	Bilateral			Unilateral		
	Total cases	Complications	Per cent	Total cases	Complications	Per cent
Spinal	181	15	8.2	51	3	5.8
Inhalation	174	21	12.0	228	12	5.2
Regional	94	5	5.3	188	6	3.1
Spinal and inhalation	19	4	21.6	3	0	0
Regional and inhalation	54	4	7.4	71	5	7.0
Intravenous sodium amytal	0	..	....	2	0	
Rectal sodium amytal and inhalation	0	..	....	1	0	
Total	522	49	....	544	26	

Anesthesia has advanced remarkably in the last few years and progress has been made by adherence to the watchword, "Suit the anesthesia to the patient, not the patient to the anesthesia." Despite reports to the contrary, in this series there seemed to be a relationship between the type of anesthesia and the complications (Table II); regional anesthesia had the least, regional

and inhalation next, and spinal next when it was not supplemented by inhalation anesthesia. When this combination became necessary, the complications were almost tripled over those cases in which spinal anesthesia alone was used, as far as bilateral herniotomy is concerned. In cases in which unilateral herniotomy was performed, the significance of the type of anesthesia is not so apparent although regional anesthesia is still accompanied by a lower percentage of complications.

In considering the duration of operation as a factor there are various angles which must be kept in mind. If the operation extended for two hours, spinal anesthesia was supplemented by inhalation anesthesia with a resultant increase in complications. This time factor is of no real significance in the unilateral group, but it is of very definite significance in the bilateral group, in which complications were double those for unilateral herniotomy. Trauma may be an additional factor; generally speaking, there is twice as much injury in bilateral herniotomy as in unilateral herniotomy.

In regard to the postoperative course, interest was centered especially on pulse rate, blood pressure and temperature. Detailed study of daily pulse rates failed to verify the opinion that rapid pulse is a factor of safety, which is assumed as a physiologic basis for administering thyroid extract as a prophylaxis against embolism. The average acceleration of the pulse rate was slightly higher in the bilateral group than in the unilateral group. In practically all the cases in the bilateral group in which complications developed there was elevation of the pulse rate, whereas in the unilateral group an increased rate was present in only about two-thirds of the cases. Approximately the same high percentage of increased pulse rates for the first three days following operation was found in cases in which complications were present; after the third day the rate for both groups was within the same range.

The blood pressure immediately following operation averaged slightly lower for the bilateral group than for the unilateral group, but no appreciable difference could be detected for either group, as between cases in which complications occurred and those in which they did not. The statistics derived from observations of the temperature were of no significance up to the time the complication developed.

Some years ago Walters advocated the use of thyroid extract, administered postoperatively in doses of 2 grains (0.12 gm.) three times a day, as a prophylactic measure against embolism. It was applicable particularly to cases in which the pulse rate was not accelerated or low, the hypothesis being that decreased rapidity of the heart's action and slowing of the entire blood stream is conducive to pathologic thrombosis, and that thyroid extract is physiologically suitable for elevating the pulse rate. Evidence that such a theory has foundation is seen in the small number of emboli following operations on patients affected with thyrotoxicosis, and in cases in which infection develops, a rapid pulse rate seeming to serve as a factor of safety.

A review of the situation with regard to the value of thyroid extract in this series of cases demonstrates that there is no significant advantage in administering it to prevent either general complications or complications which are or may be specifically of an embolic nature. One hundred fifty-four patients with bilateral hernia received thyroid extract, 368 did not receive it; 158 with unilateral hernia received it and 386 did not.

Inasmuch as thyroid extract is usually not given prior to the third postoperative day, if no good is accomplished certainly no harm is done, and if physiologic reasons for administering the drug are sound, then it is possible that a change in the time it is administered may give the desired results. It is well recognized that many people are somewhat deficient in thyroid in degrees often too small to be readily recognized. It is possible that a low early morning temperature may be the index to this type of case. For this reason we suggest that if

thyroid extract is to be used, it be given before operation and by rectum immediately following operation, so that the benefit, if any, may be obtained early rather than late. We have followed this procedure in a series too small as yet for the results to be evaluated.

It is of interest to note that of the total of 1066 patients, 161 were catheterized following operation. Of these, 157 were unable to void, and the remaining 4 were catheterized for residual urine at some time during the postoperative convalescence. The number of complications in relation to the number of catheterizations is startling. Approximately one-quarter of those with bilateral hernia were catheterized, and there were twice as many complications among those who were catheterized. One-tenth of the patients with unilateral hernia were catheterized, a little more than twice as many complications occurring among these patients as among those in the group who did not require catheterization. In other words when a patient who has undergone herniotomy requires catheterization, one should be on guard against the possibility of complications developing.

SUMMARY AND CONCLUSIONS

From a comparative analysis of the complications following operation in 522 cases of bilateral hernia and in 544 cases of unilateral hernia, it was found that there was a definitely increased risk in bilateral herniotomy performed in one stage over unilateral herniotomy. It was also found that regional anesthesia seemed to carry a lower incidence of complications than other types of anesthesia; that spinal anesthesia, when it had to be supplemented by inhalation anesthesia, was accompanied by a high incidence of complications, indicating that spinal anesthesia had best not be employed when a protracted surgical procedure for bilateral hernia is anticipated; and that the administration of thyroid extract as a prophylaxis against complications of an embolic nature administered as at present was of no value in this series of cases.

The question might legitimately be asked whether it is not just as satisfactory to repair a bilateral hernia in one stage since approximately the same risk must be taken in repairing a bilateral hernia whether it is done in one stage or two. We think that the answer to this is that if one repairs one side, accepting a known smaller risk, then if complications should develop they would indicate what must be anticipated in repair of the opposite side. Then, too, in performing the operation in two stages there is less risk of pulmonary complications because of prolonged anesthesia, often necessary in performing bilateral herniotomy in one stage.

VASECTOMY FOR PREVENTION OF EPIDIDYMITIS IN PROSTATIC SURGERY*

REPORT OF 208 CASES

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BALTIMORE

A PRESENTATION of the method and results obtained by partial vasectomy in the prevention of epididymitis in prostatic surgery seems opportune at this time for two reasons: (1) Epididymitis is an unpleasant and often serious complication in the preoperative and postoperative course of the prostatic patient; and (2) There has been a revival of interest in the incidence of postoperative epididymitis as a result of the relatively frequent occurrence following the transurethral method of treatment of prostatic obstruction in non-vasectomized patients.

Statistics show a marked variance in the incidence of pre and postoperative epididymitis in prostatic patients who have not been treated by preliminary vasoligation or vasectomy. In various urological clinics the percentage of complicating epididymitis in the non-vasectomized patients ranged from 6 per cent (Rathbun) to 82 per cent (White). In 1930 Crabtree and Brodney collected 1624 prostatectomies performed without vasoligation or vasectomy (excluding the series reported by Rathbun and White) and found that the average incidence of epididymitis occurring during the period of hospitalization was 21.6 per cent. Crockett and Washburn studied the progress of the prostatic patient after discharge from the hospital and found that in a series of 100 cases there were 16 of epididymitis (13 unilateral; 1 bilateral; 2 with abscess formation).

The consensus of opinion is that the incidence is greater after the suprapubic than the perineal operation. Aschner reviewed a series of 277 prostatectomies and observed that the incidence of postoperative epididymitis was greater in the two stage suprapubic prostatectomy (15 per cent) than the one stage operation (10 per cent). The incidence of preoperative epididymitis in the two stage operation was 5 per cent thus making a total of 20 per cent for the two stage prostatectomy. In a series of 50 suprapubic prostatectomies, White did not encounter a single case of postoperative epididymitis following the two stage operation, whereas epididymitis occurred in 86 per cent of the cases where a one stage operation was employed. In this series of 1049 perineal prostatectomies, Young found that 20 per cent developed an epididymitis.

It is generally accepted that epididymitis occurs less frequently after transurethral resection of prostate than after suprapubic or perineal operation. The incidence of epididymitis following the various transurethral methods of treatment of prostatic obstruction varies from 3 to 11 per cent with an average of about 6 per cent. In 1928 Collings reported two cases of epididymitis following electrotome excision of the prostatic bar in 30 cases, an incidence of 6.6 per cent. Engel reviewed 64 cases of transurethral operation for relief of bladder neck obstruction treated by Caulk's method (48 cases) and Stern-Davis method (16 cases) and found 4 cases of epididymitis (6.1 per cent). Haines observed 7 cases of epididymitis in a series of 27 prostatic resections (25.5 per cent) and in a series of 19 cases Dorman

* From the Urological Service, Sinai Hospital, Baltimore, Maryland.

reported 3 cases of epididymitis (7.4 per cent). Ballinger, Elder and McDonald reviewed 82 cases, 14 of which had preliminary vasoligation and observed 9 cases of epididymitis (11 per cent). In an analysis of 200 resections on 175 patients, Alcock noted 6 cases of epididymitis in 93 resections without vasectomy (6.5 per cent). In a recent report of 616 cases, Davis mentioned 19 cases of postoperative epididymitis (3.08 per cent).

Vasoligation and Vasectomy. Vasectomy as a preliminary to prostatectomy received its initial impetus in this country with a report of a series of 25 cases by Goldstein at the meeting of the American Urological Association in 1926. This was soon followed by reports on the closed method of vasoligation by Alyea and Colston in 1928. Other contributions emphasizing the advantages of ligation and resection of the vas in the prevention of epididymitis in prostatic surgery were made subsequently by McKay 1928, Meltzer 1928, O'Neil 1929, Crabtree and Brodney 1930, Davis 1933 and others.

Several different types of operations have been proposed for ligation of the vas. In 1904 Proust reported the routine ligation of the vas above the prostate in his perineal operation. In 1909 Albarran and in 1932 Burgess advocated ligation of the vas through a small incision in each groin. In 1932 Sarnoff modified this procedure by exposing and ligating the vas in each groin through a suprapubic incision at the time of suprapubic cystotomy or prostatectomy. Ligation of the vas through a small incision in the scrotum was described by Haberer in 1912 and Morson in 1923. In 1931 Keyes advocated scrotal ligation of the severed ends of the vas side by side like a double barreled gun without bringing the stumps to the skin surface, and others have proposed implanting the severed ends in the skin. In the closed method of vasoligation of Alyea and Colston, the vas is palpated through the scrotal skin and grasped with an Allis clamp or special Alyea clamp. A silkworm suture is passed through the scrotal skin under the vas and is tied on the skin surface. Davis had recently modified this technique by employing a No. 2 chromic catgut ligature inserted through the scrotal skin beneath the vas and then passed in a reverse direction through the same needle openings. This modification eliminates the skin necrosis and ulceration which frequently occurs with the Alyea-Colston method. The term, vasectomy, as employed in this paper implies a partial resection of the vas and is essentially a modification of the open method of vasoligation wherein a small portion, at least one cm., of the vas and its sheath are removed and the cut ends of the vas are ligated with chromic catgut.

Experimental studies show conclusively that simple ligation by the closed method and simple section with ligation of the severed ends by the open methods are insufficient protection against the development of an epididymitis. Rolnick studied the regeneration of the vas in animals and found that after simple ligation with absorbable material and in certain cases with non-absorbable material the vas regenerated and reestablished its lumen as early as the twenty-second postoperative day. He also found that occlusion of the lumen of the vas does not take place when the vas is sutured into the skin or is exposed outside of the skin for a number of days.

Clinical experience also emphasizes the inefficacy of vasoligation in the prevention of epididymitis. According to Crabtree and Brodney, cases have been reported wherein spermatozoa were found in the seminal vesicles or in their secretion within three months following ligation. Alyea found that 10 per cent of the patients who had a simple ligation at the time of prostatectomy developed an epididymitis, less than half of the average occurrence without vasoligation or vasectomy. In a series of 35 cases reported by McKay in which vasoligation by the Alyea method was performed, 5 patients, or 15 per cent, developed an epididymitis shortly after the removal of the ligature. Reed and

Morgan performed vasoligation following the Alyea method in 6 cases and 3, or 50 per cent, of these patients developed

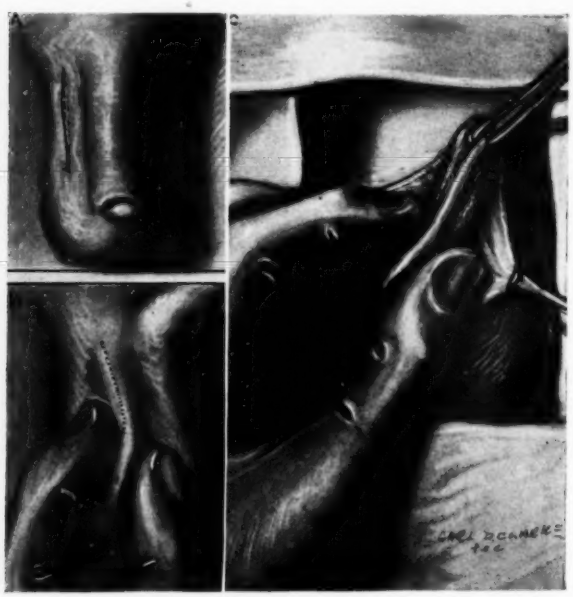

Fig. 1. Technique of vasectomy: (A) skin incision; (B) palpation of vas through scrotal skin prior to making incision; and (C) exposure of spermatic cord and identification of vas which is grasped with an Allis clamp.

epididymitis in seven to twenty-one days postoperatively. Pugh reported 125 cases of transurethral resection in which epididymitis occurred in 17 cases, 13.6 per cent, in spite of bilateral vasoligation. In a discussion of Reed and Morgan's article, Ravich and McKenna both discarded vasoligation because the incidence of epididymitis did not appear to be influenced by this procedure and the percentage was practically the same as in their unligated cases. On the other hand, since 1922 Burgess has employed the open method of bilateral vasoligation routinely in 177 prostatectomies and has not had a single case of postoperative epididymitis, whereas the previous incidence was 22 per cent.

The effectiveness of vasectomy in preventing postoperative epididymitis is borne out by the finding of Crabtree and Brodney. In an analysis of 514 cases in which vasectomy was performed, they found only 8 cases, 1.5 per cent, of postoperative epididymitis. The reduction in the incidence of postoperative epididymitis becomes more striking when compared with an incidence of 21.6 per cent of postoperative epididymitis in a series of 1624 reported cases without vasectomy or vasoligation collected by the same authors.

Technique. The technique of partial vasectomy employed in our clinic has been evolved by Goldstein. The operation consisted of simple bilateral section of the vas with ligation of the cut ends with catgut. In several cases, a portion of the vas and its sheath on each side was removed. In 1927 the latter procedure was made an essential feature of every operation on the vas performed as a preliminary measure to prostatectomy. Other refinements in technique have been made from time to time, i.e., burying the distal end with a layer of fascia and transfixing the upper end below the skin.

The operation is performed on each side through a lateral scrotal incision 2 to 3 cm. in length, the lower end of the incision situated at or above the level of the superior pole of the testicle. (Fig. 1-A.) If desired the vas may be isolated first through the scrotal skin with the fingers (Fig. 1-B) or with an Allis clamp, and the skin incision made directly over the vas. The incision is carried through the skin and subcutaneous fascia as far as the tunica vaginalis of the spermatic cord. The cord is then grasped between the thumb and index finger and the vas identified by palpation. The vas and its sheath are grasped with an Allis clamp and the remainder of the cord is allowed to drop into its normal position (Fig. 1-C). A long doubled chromic No. 2 catgut suture is passed beneath the vas and its sheath. The suture is cut into two equal lengths and each strand of catgut is pulled in opposite directions with a slight sawing motion in order to separate the vas and its sheath from the underlying tissues (Fig. 11-D). The vas and its sheath are isolated for a distance of 1.5 cm. and at least 1 cm. removed (Fig. 11-E), individually ligating the cut ends with the strands of catgut. One end of each ligature may be

left long for further suturing. The distal (lower) end of the vas is covered with a layer of tunica vaginalis by means of a continuous Lembert suture (Fig. 11-F). The proximal (upper) end is brought down and anchored to the tunica vaginalis so that a layer of tissue is interposed between the cut ends (Fig. 11-G). The skin is closed with continuous or interrupted black silk sutures. No drainage of the operative area is instituted. The wound may be covered with collodion or a dry sterile dressing and an appropriate scrotal support, i.e., suspensory or scrotal bandage made of gauze or adhesive plaster, is applied.

The time consumed by a bilateral partial vasectomy seldom exceeds ten minutes. Although the procedure in every case in this series was done in the operating room, the technique is so simple and the amount of material required so scant that the procedure can be performed easily under local anesthesia in the patient's room, the cystoscopic room or the urologist's office.

The advantages of this method of vasectomy are obvious. (1) *Adequate exposure is obtained to insure identification of the vas thus eliminating the possibility of ligating a sclerotic or thrombic vein.* (2) *The open method enables the surgeon to remove the desired amount of vas and its sheath and to ligate securely each of the cut ends of the vas including the sheath.* (3) *Regeneration of the vas is impossible as the distal end of the vas is buried in such a manner that a layer of tunica vaginalis is interposed between the cut ends.* (4) *The proximal end is anchored to the outer layer of the tunica vaginalis immediately under the skin so that if an abscess should develop in this end of the vas, it can be readily incised and drained.* (5) *Through the proximal end, the surgeon can easily inject the seminal vesicles with an antiseptic solution in order to treat or prevent an infection of the seminal vesicles.*

Analysis of 208 Cases. This study, based on 208 bilateral partial vasectomies performed in the past eight years, 1926 to 1934, on the Urological Service of Sinai Hospital, includes only those cases in which the operation was employed to prevent the development of an epididymitis in patients with prostatic disease. This series does not include the 25 cases reported from this hospital by Goldstein at the meeting of the American Urological Association in 1926.

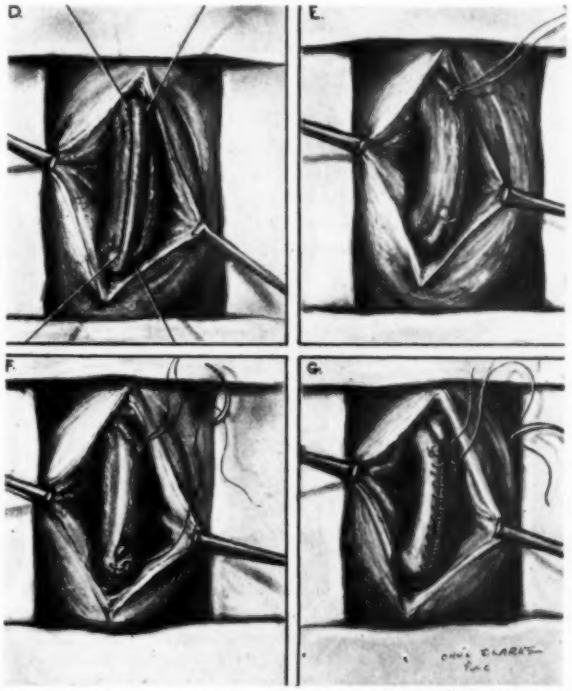

Fig. 2. (D) Vas and sheath isolated from other structures in the cord by a suture placed beneath the vas and its sheath; (E) 1 cm. of vas and its sheath removed and the cut ends securely ligated; (F) the lower distal end is covered over with tunica vaginalis by means of a continuous Lembert suture; and (G) the upper proximal end is anchored to the tunica vaginalis so that a layer of fascia is interposed between the cut ends.

In Table 1 the cases are classified according to the clinical diagnosis confirmed by either cystoscopy, operation or histological study of the operative specimen. In this compilation no attempt was made to differentiate the various anatomical or pathological types of benign enlargement of the prostate.

In this series all but 6 cases had one or more operations performed subsequent to the vasectomy. Of these 6 cases, 2 received repeated cystoscopic fulgurations for a bladder tumor and 4 were not subjected to further operative treatment for the following reasons: extremely poor condi-

tion due to presence of extensive infiltrating carcinoma of prostate; patient refused further treatment other than intermittent catheterization; and 2 patients succumbed

TABLE I
CLINICAL DIAGNOSES

I. Benign hypertrophy of the prostate	
A. No accompanying lesions	154
B. Accompanying lesions	
1. Bladder diverticulum	5
2. Bladder neoplasm	4
3. Bladder calculi	10
4. Prostatic calculi	3
5. Prostatic abscess	1
6. Pre-operative epididymitis	6
7. Hydrocele	9
8. Spermatocele	1
II. Carcinoma of Prostate	14
III. Stenosis of vesical neck following prostatectomy	1
Total	208

after vasectomy during preparation for prostatectomy. The various operations performed on the remaining patients are recorded in Table II.

TABLE II
SUBSEQUENT OPERATIONS IN 202 CASES

I. Prostatectomy	
A. One stage suprapubic	2
B. Two stage suprapubic	49
C. Perineal	87
II. Suprapubic Cystotomy	
A. Simple	6
B. Combined with:	
1. Fulguration of bladder tumor	1
2. Repair of trigon and vesical neck	1
III. Suprapubic lithotomy	1
IV. Diverticulectomy and subsequently	
A. Suprapubic prostatectomy	2
B. Resection of prostate	1
V. Resections of prostate	55
A. Resection and subsequent prostatectomy	9
VI. Prostatotomy	1
Total number of operations	215

The choice of anesthesia for vasectomy varied according to type of patient and the time of operation. Local infiltration with 0.5 per cent novocain was employed in 100 cases. Occasionally, in these cases it was necessary to block the nerves of the spermatic cord. In nervous and apprehensive individuals, other forms of anesthesia, particularly nitrous oxide inhalation (11 cases) or intravenous anesthesia with evipan (20 cases) were employed. When the vasectomy is combined with some other scrotal operation, i.e., hydrocele, spermatocele or epididymectomy, or performed at the time of perineal prostatectomy, or at one of the two stages of a suprapubic prostatectomy, a more profound and lasting anesthesia is required. Thus in 42 cases caudal anesthesia using 30 c.c. of 2 per cent novocain, was employed and in 35 cases spinal anesthesia with 100 mgms. novocain. Ether anesthesia was not used in any case except as an adjuvant to gas anesthesia in the prolonged cases.

TABLE III
TIME OF VASECTOMY

A. Vasectomy before preliminary instrumentation or catheter drainage	78
B. Vasectomy after institution of catheter drainage	75
C. Vasectomy after catheter drainage but combined with other major or minor operative procedures (55 cases) viz:	
1. One stage suprapubic prostatectomy	2
2. First operation in two stage suprapubic prostatectomy	13
3. Second operation in two stage suprapubic prostatectomy	3
4. Perineal prostatectomy	22
5. Hydrocele operation	8
6. Epididymectomy	3
7. Suprapubic fulguration of bladder tumor	2
8. Circumcision	1
9. Injection of seminal vesicles and prostate	1
Total	208

A careful study was made of the time of vasectomy in relation to (a) preliminary diagnostic instrumentation, (b) the institution of catheter drainage, and (c) subsequent operations on the prostate and bladder (Table III). The purpose of this study was to determine: (1) whether or not catheter drainage played an important role in the development of postoperative scrotal complications; and (2) the significance of the time interval between the institution of catheter drainage and the vasectomy in the prevention or development of these complications. Every patient in this series of 208 cases had catheter drainage in preparation for a prostatic operation.

In the 78 cases in group A the vasectomy was done immediately or shortly after admission and before any diagnostic instrumentation or catheterization was per-

mitted. It has been the practice, whenever possible, to insert the first indwelling catheter at the conclusion of the vasectomy. This group developed the least number of postoperative complications; viz. vasitis, 2 cases; abscess of scrotal wound, 1 case; and scrotal edema, 1 case.

In the 75 cases comprising group B for various reasons the vasectomy was performed after catheter drainage had been instituted. In some instances, the patient's condition was too poor due to uremia, cardiac decompensation, pulmonary complications, etc. to warrant the risk of a vasectomy before directing all efforts to improve the patient's general health with the usual restorative measures including catheter drainage. Several patients were admitted with chronic retention of urine and the bladder was decompressed for several days before vasectomy. In a large number of cases who had uninfected bladder urines, vasectomy was intentionally postponed for several days. The intervals of time elapsing between the institution of catheter drainage and vasectomy varied from one to thirty-four days, with an average of 9.4 days. This group showed a greater incidence of postoperative scrotal complications than group A; vasitis occurred in 5 cases, abscess of the scrotal wound in 3 and scrotal edema in 1.

In the 55 cases in group C vasectomy was postponed also until after catheter drainage had been instituted for essentially the same reasons mentioned. However, this group is distinguished from the previous group by the fact that the vasectomy in each case was combined with a major or minor operation on the prostate, bladder, epididymis, seminal vesicles, etc. The number of days of preliminary catheter drainage in this series varied from three to forty-five days, with an average of 16.4 days. It is interesting to note that postoperative scrotal complications occurred more often in this group than in either group A or B. A vasitis developed in 8 patients, 4 of them had a vasectomy combined with perineal prostatectomy, 3 with the first step of two-stage suprapubic prostatectomy and one with circumcision. An abscess of the scrotal wound occurred in one patient who had a vasectomy combined with a hydrocele operation, and scrotal edema developed in one patient who had the vasectomy at the first step of a two-stage suprapubic prostatectomy.

The more frequent occurrence of scrotal complications in group C than in group A suggests the influence of an additional factor besides catheter drainage inasmuch as vasectomy was performed after preliminary catheter drainage in both groups. This other factor in all probability is closely related to the combining of vasectomy with a major or minor operation on the bladder, prostate, scrotum, etc. A very plausible explanation is found in the contamination of the scrotal wound, which may be due either to the direct transportation or implantation by the surgeon's fingers or instruments of organisms from an infected area (scrotal skin, prostate or bladder) into the scrotal wound, or to the subsequent seepage of infected urine from a perineal or suprapubic incision into the scrotal wound or dressings. In those cases where a vasectomy is performed at the same sitting as a suprapubic cystotomy or prostatectomy or perineal prostatectomy, it has been our practice to do the bladder or prostatic operation first and then the vasectomy. This order of procedure is also followed in other clinics, notably by Keyes, who found that when vasectomy was performed before the abdomen was opened in the first or second stage of suprapubic prostatectomy, a postoperative rise in temperature from 101° to 104°F. occurred, attributed to contamination of the abdominal wound with organisms carried from the scrotal skin by the fingers despite the fact that the abdominal wound looked clean. He pointed out that when the abdomen was opened before the scrotum, the rise in temperature did not occur. However, the order of procedure is not important providing the proper precautions in technique are taken to insure perfect asepsis,

viz. the use of separate sets of instruments for each operation, careful preparation of operative area, changing operative drapings and apparel for each operation, and adequate sterilization of hands between operations.

Complications. The postoperative complications of vasectomy in this series of 208 cases are indicated in Table IV.

TABLE IV
POSTOPERATIVE COMPLICATIONS OF 208 VASECTOMIES

Condition	Cases	Percentage
Epididymitis	0	
Scrotal hematoma	2	.96
Scrotal edema	3	1.44
Scrotal abscess	5	2.40
Vasitis	15	7.21
Peritonitis or intestinal obstruction	1	.48
Total	26	12.50

Epididymitis. The development of an epididymitis following vasectomy is a rare occurrence. In the preliminary series of 25 cases reported by Goldstein, one patient, 4 per cent, developed a questionable epididymitis which on reexamination of the reported clinical findings rather appears to be a vasitis. Crabtree and Brodney reported 4 cases of epididymitis following bilateral vasectomy in a series of 141 prostatectomies.

In this series of 208 vasectomies, there were no cases of postoperative epididymitis. The value of this procedure is further emphasized by a comparative study of the incidence of postoperative epididymitis in a series of non-vasectomized patients operated in the same period of time. There were 14 cases, 11.4 per cent, of postoperative epididymitis in a series of 122 patients who had operative treatment for prostatic disease but were not vasectomized.

In addition to epididymitis, there is another group of pathological lesions which may occur after vasectomy or vasoligation. These complications are confined to the scrotum in the majority of cases, viz:

1. *Hematoma.* The formation of a scrotal hematoma usually occurs immediately after the vasectomy and is the result of puncturing one of the spermatic veins during the dissection of the vas. This is more likely to occur on the left side due to the frequent presence of a varicocele on this side. This unpleasant complication can be avoided by securing accurate hemostasis before closing the skin incision, i.e., ligation of every bleeding point in the spermatic cord, tunica vaginalis and subcutaneous tissues of the scrotum. This complication occurred in two of our patients; one was of minor degree being confined to the scrotum on the affected side and responded to local measures, the other was extensive, involving the scrotum, perineum and penis and required opening of the incision and ligation of bleeding points.

2. *Scrotal Edema.* A unilateral swelling of the scrotal tissues may develop on the morning following operation and disappear four to five days later after proper elevation of the scrotal contents and application of ice bags. It is difficult to state whether this enlargement of the scrotum is due to edema from circulatory embarrassment or to lymph stasis resulting from the trauma incidental to operation. This condition was first described in 1929 by Read and Morgan who considered it to be a circulatory phenomenon. There is no infectious process present, which with the absence of other local and constitutional symptoms, serves to differentiate this condition from an early scrotal abscess or cellulitis. A unilateral scrotal edema occurred in 2 cases and bilateral in 1 case. In each instance, the condition was asymptomatic and was determined at the first dressing on the third postoperative day. Each case cleared up in three to four days.

3. *Scrotal Abscess or Cellulitis.* This condition may be due (a) to the failure to maintain perfect asepsis at the time of operation or during the postoperative period when infected urine is permitted to seep through the dressings over the wound; (b) to the development of abscesses about the sutures in the skin; or (c) to the devel-

opment of an abscess in the proximal (upper) end of the cut vas or about the catgut ligatures on the severed ends of the vas. An unilateral and relatively mild abscess of the scrotal wound was observed in 5 cases in the author's series. One case was diagnosed on the second day after vasectomy, 2 on the fifth day, 1 each on the seventh and seventeenth day. All cases responded within two to three days to conservative treatment. Two cases were directly attributable to stitch abscesses. Scrotal cellulitis did not develop in any case.

In the early stages this condition may manifest itself by an increased moisture and slight congestion of the wound or localized abscess formation which responds well to local heat and antiseptic dressings. If the infectious process remains unrecognized, it spreads to the subcutaneous tissues of the scrotum producing an induration of the tissues surrounding the testicle which has been mistaken for an epididymo-orchitis. The application of dry or moist heat and the institution of drainage in the operative area will quickly clear up the condition. In rare instances the infection may spread from the scrotal tissues into the penis, abdomen or perineum within the confines of Colles' fascia producing a localized abscess or a diffuse cellulitis. Occasionally, the infection may even penetrate the tunica vaginalis of the testicle to produce an epididymo-orchitis which may go on to abscess formation with eventually complete necrosis of the epididymis and testicle requiring orchidectomy. The author has observed such a case following vasectomy performed at another hospital.

4. *Vasitis, with or without Localized Abscess Formation.* This condition was first described by Morson and later emphasized by Crabtree and Brodney, Swan and others. In the author's series vasitis occurred in 15 cases, 7.21 per cent, unilateral in 13 (right 5, left 8) and bilateral in 2 cases. The process was localized in every case and was confined to the proximal (upper) end of the cut vas in 14 cases and to the inguinal canal in 1. In 2 unilateral cases and 1 bilateral case, a localized abscess in the proximal end of the vas required incision and drainage. In the remaining cases, the vas showed a localized thickening which cleared after two to three days of local treatment. Of the 8 cases which developed a vasitis after vesectomy, 7 were subjected also to some other major or minor operation. In the 7 cases, vasitis developed three weeks after vasectomy.

Vasitis may occur at any time during the postoperative course, but most frequently two to three weeks after vasectomy. The earliest symptom is a persistent aching pain in the groin accompanied by a slight elevation in temperature. Examination of the tissues in the region of the external abdominal ring reveals a diffuse tender induration of the proximal end of the vas. The affected stump usually becomes enlarged, varying in size from a pea to a walnut, representing a localized inflammatory process in the stump of the vas and the immediately surrounding tissues. If the condition fails to respond to local heat, a localized abscess forms which requires incision and drainage to effect resolution. In none of the cases does the infection appear to cross the point of resection or ligation; consequently, involvement of the epididymis and testicle does not occur. The symptoms rarely persist for more than four to five days unless an abscess develops which requires drainage for several days. Occasionally the onset of symptoms may be so sudden and acute that the condition may be mistaken for a strangulated inguinal hernia, according to Morson. The condition is due to the extension of an infectious process from the prostatic area or seminal vesicles down the vas and if the vas had not been previously ligated or resected in these cases an epididymitis would develop. Rectal examination in these cases usually discloses a thickened inflamed seminal vesicle on the corresponding side. Hot rectal douches or irrigations, rectal diathermy and hot sitz baths help to clear up the seminal vesiculitis.

The development of scrotal complications following vasoligation or vasectomy adds a new morbidity factor. In his series of 25 vasectomies, Goldstein observed 3 cases or 12 per cent, of vasitis. Crabtree and Brodney collected 309 vasectomies and noted 11 cases, or 3.5 per cent, with scrotal complications. Swan and Mintz mentioned 4 cases of abscess of the scrotum following vasectomy and later Swan reported 3 additional cases and stated that 1 to 3 such cases are seen every year following vasectomy at the Massachussetts General Hospital in Boston.

In 1930 Cashman reviewed 327 cases of chronic prostatic obstruction receiving surgical treatment and found 61 patients, 18.5 per cent, developed an epididymitis. Further analysis revealed that 208 cases were not treated by vasoligation or vasectomy and a complicating epididymitis developed in 52 cases, or 25 per cent. The remainder 119 cases had some form of vasoligation, i.e., 13 cases by the closed method and 106 cases by the open method. In those treated by the closed method, there were 4 poor results, 30.7 per cent, viz. infections of the wound, sloughing, hematoma and consequently this method was abandoned. Of those treated by the open method, 5 cases, 4 per cent, developed some infection in the scrotum, 3 of which were unilateral epididymitis.

One case in our series developed paralytic ileus and died after vasectomy and is reported because of the unusual complication and the fatal outcome. A review of the literature fails to reveal a similar report.

Case Report. E. M., a seventy year old man, a tailor, was admitted at Sinai Hospital on September 5, 1932, presenting the usual symptoms of prostatism. Physical examination was negative except for a right indirect (reducible) inguinal hernia about the size of a hen's egg. Rectal examination disclosed a moderately enlarged prostate. Cystoscopy revealed an intravesical enlargement of the median and both posterolateral lobes. The bladder capacity was 300 c.c. and residual urine was 50 c.c. The usual examination of the urine and blood and renal functional tests were negative.

A diagnosis of benign hypertrophy of the prostate was made and the treatment advised was a preliminary bilateral vasectomy and subsequent transurethral resection of the prostate. At 10:00 A.M. on September 7, 1932, a bilateral partial vasectomy was performed under caudal anesthesia, using 40 c.c. one per cent novocain. At the conclusion of this operation, a No. 20 F. soft rubber urethral retention catheter was passed into the bladder and strapped in place. No difficulty was encountered in passing the catheter and no previous catheter drainage had been employed.

At 6:00 P.M. that night the patient vomited about 200 c.c. blood tinged fluid. Examination of the abdomen and throat were negative. The vomiting was attributed to effects of the anesthesia. Patient was given a hypodermic injection of ¼ grain morphine at 8:00 P.M. and fell asleep. On the following day the patient complained of marked abdominal distention and was unable to retain fluids. The temperature was 99°F. and the pulse rate varied between 72 and 84. A rectal tube and two small enemas gave little relief. The operative wounds showed no abnormal changes. The abdominal distention persisted and on September 9, gastric lavage followed by instillation of an ounce of castor oil with turpentine stupes and pituitrin were not effective in overcoming the abdominal distention. Several enemas were given but were only slightly effectual. During the day two intravenous injections of 500 c.c. of 10 per cent concentrated glucose solution were given.

On September 10, the patient's condition became progressively worse. The temperature rose to 101.6°F. and pulse to 90. He continued to vomit all fluids, the vomitus being coffee-colored and bloody. The abdominal distention persisted despite all therapeutic efforts. The scrotal wounds appeared to be healing per primum and showed no evidence of infection. The blood urea was 49.03 mgms. per cent, blood creatinin 1.8 mgms. per cent, and blood chlorides 4.78 mgms. per cent. The leucocyte count was 13,200 with 65 per cent polymorphonuclear cells. A diagnosis of adynamic ileus and pneumonia at right lower base and confirmed by a surgical diagnosis of intestinal obstruction of seventy-two hours duration.

At 1:00 A.M., September 11, the patient's condition was rapidly becoming worse, the temperature was 102°F., pulse 90, and respirations 24. The abdomen was markedly distended throughout and showed a boardlike

rigidity. There was no incarceration of the right hernia. No masses, fluid or dullness were discernible in the flanks. An enema was ineffectual. Operative interference was not deemed advisable, and seven hours later he died. Permission for an autopsy was refused.

Comment. In the absence of an autopsy, the exact nature of the intestinal obstruction was not clearly established. The possibility of a mesenteric thrombosis was considered but in the absence of a marked leucocytosis with a high polymorphonuclear count, bloody stools and cardiac pathology, this diagnosis did not seem probable. A mechanical obstruction due to an internal herniation or unrecognized carcinoma could not be entirely ruled out. Peritonitis was also considered as a probable etiological factor but the time and mode of onset of the ileus in this case rendered such a diagnosis improbable. It has also been suggested that during the vasectomy operation the scrotal sac of the right indirect inguinal hernia was injured or penetrated in some unrecognized manner and served as a focal point for the peritonitis. However, this explanation does not appear to be tenable in view of the fact that the hernia was not disturbed during the process of isolating and resecting the vas and the vasectomy was accomplished with ease. The occurrence of signs and symptoms of gastrointestinal disease of the reflex type of following operations on the lower genitourinary tract is well recognized. However, it is highly improbable that a reflex situation resulting from the scrotal operation caused such a severe and persistent paralytic ileus.

CONCLUSIONS

The following conclusions are based upon the results obtained in the series of 208 vasectomies reported herein and a review of the experiences of other authors on the same subject:

1. The incidence of preoperative and postoperative epididymitis in prostatic patients treated by prostatectomy or transurethral resection can be reduced considerably by employing vasectomy or vasoligation.

2. Vasectomy is a more satisfactory procedure than vasoligation in the prevention of epididymitis in prostatic surgery. The reduction in the incidence of complicating epididymitis with vasectomy is greater than with vasoligation. In the author's series of 208 vasectomies, epididymitis did not develop in a single case.

3. In a very small percentage of cases, epididymitis may occur after vasectomy or vasoligation as a result of (a) the lighting up of a preexisting or latent infection in the epididymis or vas, (b) hematogenous infection secondary to an intercurrent disease or focal infection (c) faulty operative technique. The first two types can not be prevented whereas the latter can be avoided.

4. Errors in operative technique can be obviated by employing the open method of vasectomy. In this manner, the vas can be accurately isolated, at least 1 cm. of the vas removed, and the cut ends of the vas securely ligated. To prevent regeneration of the vas, it is advisable to bury the distal end in the tunica vaginalis so that a layer of tissue is interposed between the cut ends of the vas.

5. Vasectomy should be performed as early as possible, preferably before urethral instrumentation or preliminary drainage with an indwelling urethral catheter.

6. Although the efficacy of vasectomy in the prevention of epididymitis remains unquestioned, a new morbidity factor has been introduced in a small number of cases by the development of a scrotal complication other than epididymitis; (a) vasitis with or without abscess formation at the proximal stump of the vas, (b) abscess of the scrotal wound with subsequent scrotal cellulitis, (c) edema of the scrotum, and (d) hematoma.

7. An unusual complication of vasectomy is an adynamic ileus which occurred in one case in the author's series.

[*For References see p.* 44.]

EXPERIMENTAL STUDIES OF BACTERIAL CHOLECYSTITIS*

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BOTH Andrews[1] and Magner,[2] studying the contents of human gall bladders removed at operation, have found 65 per cent to contain sterile bile. Osler[3] places this figure at 52 per cent. An important role in the production of cholecystitis seems to be played by factors other than infection, mainly those of a chemical nature. Recent investigations conducted by us[4] have shown that bile acids, which long have been known to be of high toxicity for tissues outside of the gall bladder, develop a definite toxicity for the gall-bladder wall itself if present in a sufficiently high concentration. Further studies are now in progress on the exact role played by the bile acids. Although the importance of infection in this connection is possibly not primary, its existence as a factor cannot be completely disregarded for several reasons. First, one is tempted to draw an analogy as regards the gall bladder from the fact that infection plays an important part in the pathology of most other organs. Secondly, one must take into account the fact that many reliable workers, after extensive studies, have concluded that infection is the main factor in the production of cholecystitis. Very little is known about the actual route which the infection follows. The five possibilities, as given in Graham's textbook,[5] are as follows: (1) descending infection from the liver; (2) ascending from the duodenum via the common duct; (3) hematogenous; (4) lymphatic; (5) directly through the gall-bladder wall from an inflamed adjacent organ. To determine the route by which the infection spreads is not the essential point of this study. Our purpose is to ascertain by animal experimentation whether or not an increase either in number or virulence of the bacteria in bile leads to cholecystitis, and whether different bacteria show different behaviors in this regard. A considerable number of bacteria may be present in normal bile, but since these gall bladders do not manifest any changes either clinically or anatomically, we are not justified in calling such bile "infected." Bile may be considered as "infected" if it contains either an abnormally high number of bacteria or bacteria of especially great virulence. The organisms might be those which occur normally or might accrue in the bile from any pathological sources in the body. Any bacteriological study of the biliary system presupposes knowledge of the normal bacteriological flora of the liver and gall bladder as well as the kind and origin of pathological organisms and the route by which these might reach the gall bladder. Since our experimental studies are based on certain fundamental factors which are considered to be proved, a brief review of the literature is in place.

The occurrence of cholecystitis in cases of typhoid fever led early investigators to consider the infectious nature of gall-bladder disease. As early as 1763, John Hunter[6] associated inflammation of the gall bladder with typhoid fever, an idea which was proved bacteriologically by Gilbert and Girode[7] in 1890 and confirmed clinically by Chiari.[8] There followed a series of experimental studies which attempted to produce "carriers" or even reactions of the gall bladder, by injection of typhoid bacilli. Blackstein[9] found the bile to contain bacteria for many days or weeks following the intravenous injection of Bacillus coli and Bacillus typhosus in rabbits. Other

* Work done in part under a grant from the Douglas Smith Foundation.

bacteria were subsequently used by further observers, Sherrington[10] injecting Bacillus anthracis, Bacillus pyocyaneus, and staphylococci and obtaining 18 "infected" biles from 49 cases. Whether or not the gall-bladder wall showed any pathology in these experiments could not be ascertained from the data given in the literature, since the chief interest of the author was directed towards the production of "carriers." Gilbert,[11] in 1894, considered Bacillus coli to be the most important organism in the production of cholecystitis and favored the idea of an ascending infection from the duodenum. This view was opposed by Cushing and Livingood,[12] who found the duodenum to be very low in bacterial content and even sterile when empty. Further contributions were made while attempting to produce stones experimentally. Cushing,[13] after direct inoculation of typhoid bacilli into the gall bladders of rabbits, observed inflammation of the gall bladders with the formation of concrements. Similar experiments were performed on dogs and rabbits by Italia,[14] who used attenuated cultures of Bacillus coli and Bacillus typhosus. This author mentions an inflamed gall-bladder mucosa, incidental to the formation of concrements. Rolleston[15] emphasizes the need for an additional factor other than the presence of bacteria, such as trauma, stones, or stasis, for the production of cholecystitis. This author points out that though the frequency of typhoid fever is decreasing (Bacillus typhosus is found in the bile in almost all severe cases of typhoid fever), there is an increase in the frequency of cholecystitis. Similarly, Osler[16] states that cholecystitis in typhoid fever occurred in only 19 of his series of 1500 cases. Later workers again considered the blood stream to be the route by which bacteria reach the gall bladder and produce cholecystitis. There was great disagreement, however, as to whether the organisms reach the gall bladder directly through the arterial blood stream or indirectly by way of the portal vein, liver, and duct system. Rosenow,[17] who demonstrated the specific affinity of streptococci and partly also of Bacillus coli to the gall bladder, considers the direct arterial route to be the

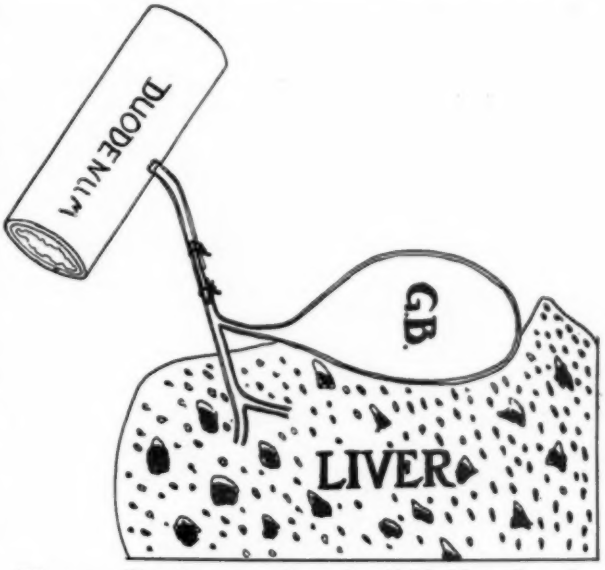

Diagram: Showing cannula and gall bladder after the common duct had been opened and the catheter introduced into the gall bladder.

usual mode of infection, since he obtained positive reactions by intravenous bacterial injection and negative results by direct inoculation into the gall bladder. Schöbl,[18] on the other hand, who tried to produce "cholera carriers" experimentally, obtained the opposite results, direct inoculation into the gall bladder being more effective than intravenous injection. There is no mention in this work whether or not a change occurred in the gall-bladder wall. Doerr[19] observed that excretion of typhoid bacilli into the bile, which occurred regularly after injection of the former into the systemic veins, could be prevented by ligation of the cystic duct. On the basis of this experimental work he concluded that bacteria indirectly reach the gall bladder by excretion through the liver. Koch[20] and Chiarolanza,[21] however, arrived at the opposite conclusion. Typhoid bacilli were found in the gall bladder after intravenous injection even after a preceding ligation of the cystic duct. This observation, together with the fact that microscopic study of a large number of inflamed gall bladders revealed "emboli" in the

folds of the mucous membrane, led these authors to conclude that "a transverse infection of the wall" is the usual route. Nichols[22] concurred with the hematohepatogenous route of Doerr on the basis of his work on rabbits. This author found that injection of typhoid bacilli into the mesenteric veins yielded "gall-bladder lesions" in 63 per cent of the cases, while injection into the ear vein resulted in only 41 per cent of positive cases. Emmerich and Wagner,[23] after direct injection of typhoid bacilli into the gall bladders of rabbits, obtained a chronic infiltration and thickening of the gall-bladder wall. However, the fact that these animals had been immunized with typhoid serum previous to the injections might have slackened and diminished the inflammatory reaction. In contrast to these observations, Venema,[24] in similar experiments, obtained a normal gall bladder. In 1921 Meyer[25] and his co-workers confirmed the validity of the hematohepatogenous route, which they believed to be the only one proved definitely in the literature, by observing positive reactions in the gall bladders of rabbits both by intravenous injection of typhoid bacilli and direct inoculation of the same organism into the gall bladder. Rosenow's theory of a hematogenous infection was further enhanced by Brown,[26] who found mainly streptococci in the emulsified gall bladder tissue from human cases of cholecystitis. This author demonstrated serologically the direct etiological importance of these streptococci and demonstrated their specific affinity for the gall bladder by intravenous injection in rabbits. The very complete survey by Magner and Hutcheson revealed that the most common organism in the cavity of the gall bladder is Bacillus coli, while in the wall it is streptococcus. These workers injected staphylococci into both the wall and cavity of rabbits' gall bladders and in every instance of subserous injection obtained positive reactions in the gall-bladder walls, but in only a limited number of cases following injection into the lumen. Hunlemüller,[27] examining gall bladders obtained at human operations, revealed positive bacterial cultures in 100 per cent of cases when he included in his statistics both the gall-bladder wall and the liver. During the last ten to fifteen years the belief in the infectious origin of cholecystitis has become considerably weakened. Wherever the infectious theory is still maintained, the route is considered to be especially by way of the lymphatics from the liver, as suggested by Graham. In 1922, Drennan,[28] who emphasized the antibacterial activity of the bile, found only 19 of 100 biles removed at operation, to be infected. The scarcity of clinical signs of infection, the lower fever and slight leucocytosis, as well as the rare occurrence of leucocytes in bile even in cases of so-called "empyema," based upon a study of a large amount of surgical and necropsy material, convinced Denton[29] that infection does not play a primary role in the production of cholecystitis but that certain other factors, such as mechanical or chemical ones, are the basic causes. Feinblatt,[30] in a study of 400 clinical cases, obtained results similar to Drennan and Denton, observing very few inflammatory changes in the gall-bladder wall and very few leucocytes in the bile or fluid content.

From this brief review of the literature, one can see the present confused state of the question of the relationship between the bacterial content of the gall bladder and the pathology of that organ. The information yielded by different authors varies considerably and often is contradictory. While bacterial studies of the gall bladder obtained at human operations and postmortem examinations are reliable and valuable, experimental studies of the same problem are much less satisfactory, due to the differences in the techniques employed by various investigators, some of which may be actually misleading. The commonest method, introduction of the bacteria by means of a needle puncture through the gall-bladder wall, often results in a localized injury to the wall at the point of puncture, thus making the results uncon-

trollable. This disadvantage was recognized by many early workers, Rosenow stating that "localized cholecystitis occurred at the point of puncture when the injection was made directly into the gall-bladder." Similarly Venema mentions the fact that the infection produced by the usual technique, which consisted of needle puncture with subsequent tying off of that part of the wall, is especially marked and is accompanied by a severe injury to the gall bladder wall. According to Wilkie,[31] the changes at the neck of the gall bladder, where the injection had been made, contrasted sharply with the fundus of the organ, which still appeared normal. The work of Phemister[32] and Graham,[33] however, indicates that it is possible to obtain normal gall bladders even with this usual technique, if the proper degree of care is administered. In experiments with dogs, Phemister injected Streptococcus viridans intramurally and performed in addition a cystic duct ligation, yet the gall bladders remained normal in all but one case, where a subsequent mixed infection accounted for the marked inflammatory changes. Similarly, Graham and Peterman obtained negative results following the injection of Bacilli coli into the wall of the gall bladder in dogs. In this instance, however, additional ligation of the blood vessels or cystic duct resulted in definite changes.

Some improvement of the needle puncture technique was made by Venema, who cauterized the wall at the point of the injection. It is perhaps to this improved technique that we can attribute the fact that this author obtained normal gall bladders after direct inoculation of typhoid bacilli, while similar experiments by Emmerich and Wagner yielded positive reactions. Hospers[34] varied the procedure by making the injection through the liver surface of the gall bladder, a method which leaves the free surface of the gall bladder practically unharmed, as we have seen, but may cause occasional bleeding in the liver tissue and thus influence the adjacent gall bladder. The method of intravenous injection practiced by Rosenow and many others is much more satisfactory. A positive reaction of the gall bladder following an intravenous injection of bacteria may be attributed with certainty to a specific affinity of these organisms to the biliary system. Negative results are valueless in this connection. Although the organisms may not reach the gall bladder via the blood stream, they may still possess a definite affinity for the biliary system if brought there by any other way. Another disadvantage of intravenous injection is the production of a bacteremia, which ordinarily is not present in cases of human cholecystitis, and might facilitate the production of cholecystitis by causing an abnormal reaction of the organism as an entity.

It is now evident that there is great doubt as to which route bacteria actually follow, under either normal or pathological conditions, which are found eventually in the gall bladder. Consequently we will limit ourselves to the effects of the actual presence of organisms in the gall bladder either of especially great virulence or in abnormally high numbers. This condition can be created experimentally by means of our "nontraumatizing" technique.[35] We employed this procedure in most of our experiments, using the method of injection by a fine needle puncture in only a few instances, which served to compare the two techniques.

Method. Only dogs were used in our experimental work, the operations being performed under ether anaesthesia and strictly aseptic conditions. The abdomen was opened by a midline incision and the common duct incised close to the duodenum. A soft French rubber catheter was introduced into the gall bladder and 10 to 15 c.c. of bile were aspirated by means of a syringe. Injection of the bacterial suspension was accomplished at this point by means of another syringe, and this was followed by re-injection of the aspirated bile into the gall bladder, thus washing the common and cystic ducts as free as possible

from bacteria. It might incidentally be mentioned at this point that this washing was sufficiently effective to prevent any marked infection of the mucous membrane of the ducts. The catheter was then withdrawn and a glass cannula inserted into the opening which had been made in the common duct. By means of this technique, the gall bladder in most instances was not visualized during the entire procedure, practically assuring freedom from traumatization. In those instances in which we failed to introduce the catheter into the gall bladder, we injected the bacterial suspension by means of a direct needle puncture and in addition performed a ligation of the cystic or common duct. For this injection, we preferred always to use the liver surface of the gall bladder rather than the free surface, thus minimizing the amount of trauma to the gall-bladder wall. In several cases a needle puncture was used for the injection without any duct ligation, to determine whether or not stasis of the bile favors infection of the gall-bladder wall. The simple catheter-cannula technique is the only method that has yielded normal controls. It has always been a handicap in gall bladder studies that if injection was made through the gall-bladder wall a considerable degree of cholecystitis might arise and furthermore if the duct was ligated or drained externally, the control experiments very frequently were not normal. Therefore we have never been able previously to either remove or introduce material into the gall bladder without causing some degree of damage, which vitiates the experiment.

The diagram shows the cannula in place after the common duct had been opened and the catheter introduced into the gall bladder.

The bacteria used for injection were obtained from human sources, as acute adenitis, sinusitis, acute and chronic mastoiditis, etc. The cultures were of recent isolation. The organisms were suspended in saline solution, in a concentration of approximately 500 million bacteria per c.c., the criterion used being the cloudiness of the suspension as compared with one of known bacterial content. One c.c. of this suspension was generally the amount injected. Wherever a marked reaction occurred, the experiment was repeated with 0.5 c.c. or less, while 2 c.c. were used in those cases in which there was no reaction. The dogs were electrocuted twenty-four hours after the operation and postmortem examination performed as soon as possible. A microscopic examination of the gall-bladder wall was made in every case except those which died spontaneously and where postmortem changes had occurred. Those animals which died from any other cause, as leakage from the gall bladder or ducts, pneumonia, etc. were not included in this study.

Protocols. In all, 36 dogs were operated. In Charts I, II and III are shown the detailed results of the experiments. A gall bladder was considered to be normal if it revealed no changes either on gross or microscopic examination. "Cholecystitis 1" indicates that the gall-bladder wall was of normal thickness, but there was some edema and congestion in the serosa. A fibrinous membrane was either completely absent or seen only in places. "Cholecystitis 2" included those cases in which the gall-bladder wall was thickened up to 4 mm. and the inflammatory signs were more definite, the fibrinous exudate covering the serosa as a thick membrane. "Cholecystitis 3" indicates that the wall is thicker than 4 mm., the gall bladder usually lies imbedded deeply in the liver, and the adjacent organs, the duodenum, omentum, etc. form a large inflammatory tumor around it. The terms "about normal" or "slight reaction" were used in those cases in which the changes were non-inflammatory in character, i.e., distention of the gall bladder, congestion of the serosa without any edema or fibrinous exudate, mechanical injury to the wall, etc. Whenever the introduction of the catheter or insertion of the cannula was attended with difficulty, the term "traumatization" was included in the column

labelled "complications." Wherever this happened the value of the experimental results are limited, as they are in those instances in which the animals died spontaneously and postmortem changes occurred in the gall bladder. Similarly, experiments in which the common or cystic duct was tied are of value only when the gall bladder remained normal in spite of the bacterial injection and duct ligation.

Chart 1
STREPTOCOCCUS HEMOLYTICUS
Strain from: (1) Acute mastoiditis 1—3 dogs
(2) Acute sinusitis—6 dogs
(3) Acute mastoiditis II—2 dogs
(4) Chronic mastoiditis—1 dog

Exp't. No.	Strain Injected	Amount	Method of Introduction	Duct	Complications	Results
1	Acute mastoiditis 1	0.5 cc.	Catheter	Cannula	Dying when electrocuted	Cholecystitis 3, bile peritonitis
2	Acute mastoiditis 1	3 drops	Catheter	Cannula	Died	Cholecystitis 3, post-mortem changes
3	Acute mastoiditis 1	3 drops	Catheter	Cannula	Very sick	Cholecystitis 2–3
4	Acute sinusitis	2 cc.	Catheter	Cannula	.....	Gall bladder normal
5	Acute sinusitis	1 cc.	Catheter	Cannula	.....	Gall bladder about normal
6	Acute sinusitis	2 cc.	Catheter	Cannula	.....	Gall bladder normal
7	Acute sinusitis	1 cc.	Catheter	Cannula	.....	Cholecystitis 1
8	Acute sinusitis	1 cc.	Needle puncture	Common duct ligation	.....	Thickening of gall-bladder wall
9	Acute sinusitis	1 cc.	Catheter	Cannula	.....	Gall bladder about normal
10	Acute mastoiditis II	1 cc.	Catheter	Cannula	.....	Gall bladder normal
11	Acute mastoiditis II	1 cc.	Catheter	Cannula	.....	Gall bladder normal
12	Chronic mastoiditis	1 cc.	Catheter	Cannula	.....	Gall bladder normal

Results. Since streptococci and Bacillus coli are the organisms most commonly accused of being the causative agents in the production of gall-bladder infection, we placed special emphasis in our experimental work on the actual effect which these bacteria have. Very striking results were obtained with Streptococcus hemolyticus, the details of which appear on Chart 1. Four different strains of the organism were used for the injections. Although three of the four strains used were from acute human infectious processes, only one produced changes in the gall bladder. The changes were very marked and occurred in the 3 cases in which this particular strain was injected. One of these animals died within fifteen hours after the injection, the second was moribund in twenty-four hours, and the third was in poor condition when killed. Only three drops had been injected into the animal which died. These results are in direct contrast to the experiments on nine dogs in which the other three strains of Streptococcus hemolyticus were injected. None of these animals died spontaneously nor did any of them exhibit any marked signs of illness during the twenty-four hours between the injection and electrocution. In 5 of these 9 cases, postmortem examination revealed perfectly normal gall bladders, while in 3 other cases the changes were very slight and not inflammatory at all. In only one instance, that of dog No. 7, did a slight but definite cholecystitis develop following injection of the Streptococcus hemolyticus from an acute sinusitis, and the technique was not accountable for this change.

The injection of Bacillus coli yielded definitely negative results, which are summarized on Chart II. In 3 cases in which the catheter method had been employed the gall bladder remained perfectly normal.

In 4 animals in this group (4, 6, 7 and 8), the slight changes manifested could definitely be attributed either to traumatization at the time of operation or to the ligation of the cystic or common duct. In none of these were the changes so marked that they could be attributed to the bacterial injection. Only one gall bladder (dog No. 5) revealed an intense reaction, apparently due to the ligation of the common duct.

From Chart III it can be seen that the results likewise are negative. None of the organisms caused any inflammatory changes on the gall-bladder wall and any slight change which occurred could easily be attributed to traumatization or duct ligation.

The charts show that when the same type of bacteria is injected through the catheter the gall bladder remains normal, but if injected by needle puncture, or if the cystic or common duct ligation is added, then they cause cholecystitis or death.

Microscopic examination of the gall bladder in the experiments where streptococcus hemolyticus isolated from acute mastoiditis cases had been injected, reveals that the enormous thickening of the wall is caused chiefly by a swelling of the serosal layer to about five times its normal thickness. The latter is edematous and hyperemic, contains a leucocytic infiltration, and is covered with a purulent fibrinous exudate. Although there is a scattered leucocytic invasion of the muscular layer, this as well as the mucosal surface is mostly unchanged. Those gall bladders, however, into which had been injected another strain of Streptococcus hemolyticus as well as Staphylococcus, Bacillus Welchii and Bacillus coli, proved to be practically normal both grossly and microscopically.

In summarizing these experimental results, we may conclude that there is little tendency for an acute bacterial infection of the gall-bladder wall to result from the contents of that organ. Only Streptococcus hemolyticus gave a positive reaction, and this only in the case of one of the four strains used. Since traumatization or extension from an adjacent pathological process can be definitely ruled out as a cause for this change, we may deduce that the organism or its toxins present in the bile reached the serosal layer of the wall by traversing the mucosal and muscular layers without causing any changes in these. None of the other organisms injected, although present in the bile in overwhelming numbers, caused any change in the gall-bladder wall.

The experimental results we obtained partly confirm and partly contradict those reported in the literature. We found bacterial infection of the gall-bladder wall

CHART II
BACILLUS COLI

Exp't. No.	Bacteria Injected	Amount	Method of Introduction	Duct	Complications	Results
1	B. Coli	1 c.c.	Catheter	Cannula	.....	Gall bladder normal
2	B. Coli	1 c.c.	Catheter	Cannula	.....	Gall bladder normal
3	B. Coli	2 c.c.	Catheter	Cannula	.....	Gall bladder normal
4	B. Coli	1 c.c.	Catheter	Cannula	Some traumatization	Cholecystitis 1
5	B. Coli	1 c.c.	Needle puncture	Common duct ligation	Some traumatization died	Cholecystitis 3, postmortem change, bile peritonitis
6	B. Coli	1 c.c.	Needle puncture	Common duct ligation	Very sick	Dilated gall bladder with fibrinous exudate
7	B. Coli	1 c.c.	Needle puncture	Common duct ligation	.....	Gall bladder about normal
8	B. Coli	1.5 c.c.	Needle puncture	Cystic duct ligation	.....	Slight reaction on gall bladder

to occur less frequently than recorded by other authors. All observers have described the streptococcus as playing an important part in producing inflammation of the gall-bladder wall. The diverse results we obtained with different strains of this organism concur with the observations of Rosenow and Magner and Hutcheson, who stressed the varying activity within this group on the basis of differences in virulence. Magner and Hutcheson divided the streptococci into two chief groups, which they classified as typical and atypical:

Typical streptococci were characterized by the formation of smooth, non-hemolytic, colorless or green colonies on blood agar, and by the fact that they were killed by exposure to the action of bile. Atypical streptococci were characterized by the formation of rough, non-hemolytic, white colonies on blood agar, and by the fact that they were not killed by the action of bile. Chronic cholecystitis was produced in 100 per cent of cases by injecting typical streptococci under the serous coat of a rabbit's gall bladder.

The negative results we obtained using Bacilli coli stand in direct disagreement both with the clinical data reported by Gilbert and the experimental work done with this organism by Italia. However, the fact that Staphylococcus aureus and albus, Streptococcus viridans and Bacillus Welchii, all failed to produce cholecystitis, agrees in the greater part with the results reported in the literature.

CHART III

(1) Staphylococcus albus—3 dogs
(2) Staphylococcus aureus—6 dogs
(3) Streptrococcus viridans—3 dogs
(4) Bacilli Welchii—4 dogs

Exp't. No.	Bacteria Injected	Amount	Method of Introduction	Duct	Complications	Results
1	Staph. albus	1 cc.	Catheter	Cannula	.....	Gall bladder normal
2	Staph. albus	1 cc.	Needle puncture	.....	.....	Gall bladder normal
3	Staph. albus	1 cc.	Needle puncture	Cystic duct ligation	Traumatization	Slight reaction on gall bladder
4	Staph. aureus	1 cc.	Catheter	Cannula	.....	Gall bladder normal
5	Staph. aureus	1 cc.	Catheter	Cannula	.....	Gall bladder about normal
6	Staph. aureus	2 cc.	Catheter	Cannula	.....	Gall bladder normal
7	Staph. aureus	2 cc.	Catheter	Cannula	Traumatization	Bile peritonitis, some reaction on gall bladder
8	Staph. aureus	2 cc.	Needle puncture	.....	.....	Slight reaction on gall bladder
9	Staph. aureus	1 cc.	Catheter	Common duct ligation	Died	Cholecystitis 3, postmortem changes
10	Strep. viridans	1 cc.	Catheter	Cannula	.....	Gall bladder about normal
11	Strep. viridans	1 cc.	Catheter	Cannula	.....	Gall bladder normal, some bile peritonitis
12	Strep. viridans	2 cc.	Catheter	Cannula	.....	Gall bladder normal
13	B. Welchii	1 cc.	Catheter	Cannula	.....	Gall bladder normal
14	B. Welchii	0.5 cc.	Catheter	Cannula	.....	Gall bladder normal
15	B. Welchii	1 cc.	Catheter	Common duct ligation	Traumatization died	Postmortem change on gall bladder
16	B. Welchii	0.5 cc.	Needle puncture	Common duct ligation	.....	Gall bladder about normal

SUMMARY

1. Animal experimentation conducted on 36 dogs indicates that an increase either in the number or the virulence of bacteria

in gall-bladder bile using a non-traumatizing technique, seldomly produces a reaction in the gall-bladder wall. A severe infection of the wall was obtained in 3 dogs, which had been injected with one particular strain of Streptococcus hemolyticus. The gall-bladder wall remained practically unchanged, however, upon the injection of three other strains of Streptococcus hemolyticus, as well as Bacillus coli, Streptococcus viridans, Staphylococcus aureus and albus, and Bacillus Welchii.

2. In many cases the same organisms injected directly through the gall-bladder wall, or with an accompanying ligation of the common or cystic duct, produce severe or even fatal cholecystitis.

CONCLUSION

The results seem to confirm the earlier statement of Graham that cholecystitis of biliary origin is difficult to produce without the additional factor of trauma or stasis.

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ROTARY DISLOCATION OF ATLAS ON AXIS*

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A SMALL number of cases of traumatic rotary dislocation of the atlas on the axis are reported in the literature. Brooks reports a group of cases in conjunction with other cervical injuries; Langworthy reports 13, Coutts 8 and Jackson 4 cases, but most authors report one or two cases. In this paper I desire to add 9 cases.

Judging from the small number of cases, one might assume that the accident is quite uncommon. I believe that it occurs more frequently than generally indicated and that the correct diagnosis is rarely made. For this reason I feel that it is desirable to report a few of these cases so as to bring this condition to the attention of the profession in general.

ANATOMY

The atlanto-axial articulation is complicated in construction. There are four definite and distinct joints. (1) The two gliding joints between the lateral masses on each side. Both articular facets of the atlas and axis are convex, although the inferior facets of the atlas are more acute than those of the axis. The surfaces of both are directed forward, downward, and outward. (2) The atlanto-odontoid joint which is between the posterior surface of the anterior arch of the atlas and the odontoid process. This is a rotary or pivot joint. (3) The transverse odontoid joint between the posterior surface of the odontoid process and the transverse ligament. This is a sliding joint.

The atlas and axis are bound together by the anterior and posterior atlanto-axial ligaments. The transverse ligament is attached to a prominent tubercle on the inner side of each lateral mass and passes just posterior to the odontoid process. The continuity of the spinal canal and the normal relationship of the two vertebra are directly dependent upon ligamentous structures. Rupture or relaxation will permit dislocation and encroachment upon the neural canal.

ROENTGENOGRAPHIC FINDINGS

Difficulties are frequently encountered in obtaining satisfactory roentgenographic studies of this area. Frequently a definite diagnosis cannot be made from the *x*-ray films. In numerous instances the patient cannot cooperate for *x*-ray examination on account of his deformity.

To obtain a thorough roentgenographic study both anteroposterior and lateral pictures must be made. The axis of the *x*-rays for the anteroposterior view should pass through the center of the open mouth. For the lateral view it should be centered on the atlas.

In the anteroposterior view Coutts has emphasized the importance of the lateral deviation of the spine of the axis. This deviation is toward the same side as that to which the rotated chin points. For example, if the chin is pointed to the right, the spine of the axis will be to the right of the midline, with each successive cervical spine being nearer to the midline. This is in contradistinction to the position of the spines in normal rotation of the head. Here they will be found on the opposite side. This deviation is due to the attempt of the cervical spine to bring the dislocated atlas to the "eyes front" position.

Dislocation of one facet of the atlas will result in an overlapping or narrowing of

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the joint space on the affected side and probably some widening at the other side.

The two sides of the posterior arch are not directly superimposed on each other in a direct lateral view. The posterior arch will

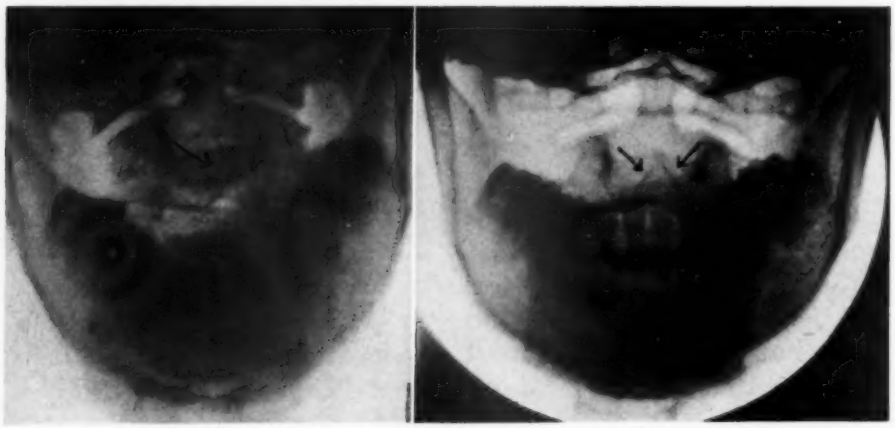

Fig. 1. Fig. 2.

Fig. 1. Case VIII. Before reduction: Rotary dislocation anteriorly of the right lateral mass of the atlas on the axis Spinous process of the axis points to the left of the midline in the same direction as the chin.

Fig. 2. Figure 1 after reduction. Spinous process of the axis and the chin both point toward the midline.

Fig. 3. Case VI. Rotary dislocation anteriorly of the right lateral mass of the atlas with almost complete obliteration of the intervertebral space between the atlas and axis on the right side.

The appearance of lateral displacement of the atlas on the axis may be the result of projection on a partially rotated atlas and must be thoroughly studied.

Fig. 4. Anterior displacement of the atlas will show divergence of lines drawn through the base of the atlas and the base of the spinous process of the axis. Normally they are parallel or converge.

appear broader than normal in a unilateral dislocation.

Any degree of anterior displacement of the atlas will be revealed by a divergence of the lines of the body of the atlas and spine of the axis. Normally they converge or are parallel.

MECHANISM OF DISLOCATION

The primary function of the atlanto-axial joint is to permit rotation of the head. Anatomically this is a gliding joint in which normal movements are controlled by numerous and relatively lax ligaments, reenforced by the muscles used to rotate the head.

The degree of difference between the full normal range of motion and simple rotary dislocation is very slight. According to Corner, sudden, unexpected, mild force applied to the limit of the former motion results in the rupture of a part of the capsular ligament with the dislocation of one of the atlantoid facets.

ETIOLOGY

Berkheiser and Seidler, Coutts, et al., have described a number of cases of distention luxation which are the result of effusion into the atlanto-axial joints, secondary to upper respiratory disease. A few of these cases occurred following paralysis of the cervical muscles due to anterior poliomyelitis. The cases I am discussing are all the result of trauma. In many instances the trauma was so mild that dislocation would seem impossible.

SYMPTOMS

The typical case gives a history of some type of accident causing a sudden forcible twisting of the head, but a sudden voluntary twist of the head often accomplishes the same result (*see* Case VII). The accident is followed immediately by a severe pain in one or both sides of the neck and inability to move the head, particularly in rotation. Any attempt at motion aggravates the pain. In some cases there is difficulty in opening the mouth. Usually the patient is treated for everything from torticollis to quinsy, without relief.

SIGNS

The classical position of the head and neck is pathognomonic. Once the deformity has been seen, the diagnosis will rarely be missed in a subsequent case.

The chin points away from the side that is dislocated. The head is tilted toward the dislocated side. There is no rotation toward the affected side and very slight rotation away from it. Slight flexion and extension may be present. The head is supported by the hands when the patient arises from the recumbent position.

Fig. 5. Typical deformity of the head in an anterior rotary dislocation of the right lateral mass of the atlas on the axis.

Palpation of the neck reveals the spinous process of the axis on the opposite side of the midline from the side which is dislocated, that is, toward the side to which the chin is rotated. This deviation is increased as the head is straightened. The patient of Case IV was treated for several weeks for an enlarged gland in this region. In reality it was a spastic group of muscles over the posteriorly displaced lateral mass of the atlas which was mistaken for a glandular swelling.

DIAGNOSIS

The diagnosis is based upon the following findings:

(1) History of forcible twisting of head;

(2) Typical attitude of head and neck in fixed rotation and tilt;

(3) Spine of the axis is displaced from the midline to the same side as that to which the chin points;

(4) Straightening the head increases the deviation of axial spine from the midline.

Rotation of the head away from the dislocated atlas facet permits the axial spine to reach the midline.

(5) Roentgen ray reveals:

(a) A narrowing of the atlanto-axial intervertebral space on the dislocated side and widening of the other;

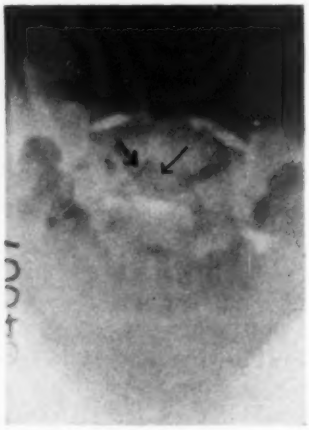

FIG. 6. Case IV. Bilateral rotary dislocation of the atlas on the axis. The right lateral mass was anterior. The spinous process of the axis points to the left of the midline.

(b) The posterior arch of the atlas appears broadened;

(c) There may be a divergence of the lines of the base of the atlas and the lower border of the spine of the axis;

(d) The inverted V-shaped spinous process of the axis will be seen on the same side of the midline as that to which the chin points.

TREATMENT

Reduction is obtained by (1) constant traction with the jury-mast, (2) forcible manipulation under anesthesia, or (3) open reduction. Eight of our cases were reduced by the use of the jury-mast.

Case IV had unsuccessful traction by a jury-mast for three weeks. Manipulation by the Walton method was then tried without success. This failing, an attempt was made at open reduction. During the manipulation a carelessly placed hemostat tore a hole in the vertebral artery. A large amount of blood was lost before the bleeding was controlled and the operation had to be stopped with hemostats left in the wound. These were later removed and the wound closed. The jury-mast was reapplied, and fifty-six days from admission the reduction was complete.

Traction is accomplished by placing the patient on a Bradford frame, the head of which is 12 to 18 inches higher than the foot, in order that the weight of the body may be used for countertraction. The patient is strapped to the frame to prevent motion. This is particularly necessary in children. A small pillow or rolled sheet is placed under the neck, or the frame may be curved to obtain hyperextension. Fifteen to twenty pounds of weight are used in adults. The traction must be constant except while the patient is eating. Sedatives are usually indicated the first few days.

FIG. 7. Figure 5 in a retention cast after reduction.

When reduction has been accomplished the deformity disappears and the patient is able to turn his head from side to side without pain. Roentgen ray examination will reveal normal relationship of the atlas and axis.

A plaster cast of the head and chest is then applied by one of two methods. If the patient is able to sit up, he is placed on a stool with the body erect and the head held in hyperextension by a jury-mast made of a muslin bandage. This is easily removed after the cast has dried. Some patients are very nervous and will faint if they are in a sitting position, necessitating the application of the cast in the supine position. To

do this we use the regular Albee fracture table. The patient is put in the reverse position with the head at the foot of the table; the shoulders and upper part of the body rest on the spinal support which extends to the first dorsal vertebra. The head is held by an assistant in the hyperextended position with the muslin jury-mast or halter. After the cast dries the spinal support is pulled out of the cast.

Felt should be placed under the cast over the shoulders to relieve pressure. Chamois skin is placed under the chin to prevent irritation. Windows for the ears should be cut in the cast, and sufficient space should be allowed in the axilla to permit free movement of the arms. At the end of two or three weeks the head portion of the cast may be removed for the comfort of the patient.

In our cases the casts remained in place five to eight weeks. During this period all patients were ambulatory. Following the removal of the casts physiotherapy was instituted for a period of two or three weeks.

Some authors prefer forcible reduction by manipulation under anesthesia. From a review of the literature the Walton method seems to be the procedure of choice. Langworthy reduced all 13 patients in his series by this method. Brooks applied the Walton method by itself or in conjunction with the Taylor procedure in his series.

Walton's method is done by the hands of the operator. In a unilateral anterior dislocation to the left the right hand is placed under the jaw and neck on the right side and the left on the forehead and face on the left side. The head is then rotated to the right to increase the deformity and disengage the facets. At this point the head is tilted to the right to raise the facet of the atlas over the facet of the axis. The head is then rotated to the left and brought back in hyperextension as the facet rides back into normal position. This procedure should be performed under anesthesia.

Any manipulative procedure entails a certain element of danger. Jackson reports a case that immediately developed a convulsion followed by deep syncope for several minutes.

	SEX	AGE	PERIOD OF DISLOCATION	HISTORY	ANTECEDENT DISEASE
1	F.	19	2 weeks	Followed fall from fainting.	None.
2	M.	10	3 days	Occurred during wrestling match	None.
3	F.	56	5 months	Result of somersault in gymnasium class.	Hypertrophic osteoarthritis of cervical spine.
4	F.	9	3½ months	Knocked down by schoolmates.	Upper respiratory disease
5	M.	3	2 weeks	Fell off porch roof.	None.
6	M.	13	1 day	Boxing with brother.	None.
7	F.	23	1 day	Sudden voluntary twist of head.	None.
8	M.	12	1 day	Struck on head playing basketball.	None.
9	M.	51	7 weeks	Automobile accident.	None.

Fig. 8. Table for comparison of cases.

Open reduction has been done in a few cases but is rarely necessary.

PROGNOSIS

Simple uncomplicated rotary dislocation of the atlas can be reduced by traction or manipulation in practically every case.

	TYPE OF DISLOCATION	X-RAY FINDINGS	METHOD OF REDUCTION
1	Unilateral right anterior	Unsatisfactory	Extension with jury-mast
2	Unilateral left anterior	Unsatisfactory	Extension with jury-mast
3	Unilateral left anterior	Positive	Extension with jury-mast
4	Bilateral—right anterior and left posterior	Positive	Jury-mast, Walton manipulation, open reduction.
5	Unilateral left anterior	Unsatisfactory	Extension with jury-mast
6	Unilateral right anterior	Positive	Extension with jury-mast
7	Unilateral right anterior	Positive	Extension with jury-mast
8	Unilateral right anterior	Positive	Extension with jury-mast
9	Unilateral right anterior; fracture, right lateral mass.	Positive	Extension with jury-mast

Fig. 9. Table for comparison of cases.

Once reduced, if it is retained in position for several weeks by casts or some other retention apparatus, the probability of

recurrence is remote. One exception to this rule is found in Case VI; the patient suffered the same anterior rotary dislocation of the atlas on two different occasions within a period of eight months. However, a careful study of the history discloses the fact that each dislocation was the direct result of a blow delivered in such a manner as to cause this type of dislocation.

	TIME REQUIRED FOR REDUCTION	PERIOD IN CAST	END RESULTS
1	14 days	6 weeks	Complete recovery
2	6 days	6 weeks	Complete recovery
3	10 days	4 weeks	Complete recovery as far as dislocation is concerned
4	51 days	8 weeks	Slight limitation of motion to right
5	6 days	6 weeks	Complete recovery
6	5 days	6 weeks	Complete recovery
7	3 days	6 weeks	Complete recovery
8	7 days	6 weeks	Complete recovery
9	6 days	8 weeks	Complete recovery

FIG. 10. Table for comparison of cases.

CASE REPORTS

CASE I. Mrs. L. G., a white female, aged nineteen years, came to the Wheeling Clinic on July 13, 1928, complaining of a stiff and painful neck and inability to rotate the head.

The history revealed that two weeks previously while working in the kitchen she suddenly fell to the floor in a faint. On regaining consciousness she experienced a severe pain in her neck and was unable to turn her head or open her mouth but a short distance. For two weeks she was treated by several different doctors for tonsillitis and enlarged cervical lymph glands without any improvement.

Physical examination revealed the typical rotary dislocation of the atlas to the right. She could not rotate the head to the right. The mouth could only be opened a short distance and there was a tender lump over the region of the atlas and axis on the left side posteriorly. The spine of the axis was palpable to the left of the midline.

Roentgen ray examination was not satisfactory due to inability of the patient to cooperate because of the painful deformity.

The patient was placed on a Bradford frame which was hyperextended in the cervical region. A jury-mast was applied with fifteen pounds traction, which was increased to twenty pounds in a few days. Reduction was effected in about two weeks. On August 1st a plaster cast was applied to the neck and chest with the patient in the sitting position and the head held in hyperextension with a jury-mast. This proved so uncomfortable that it had to be removed on August 8th and was replaced with a complete head and chest cast. She was discharged from the hospital on August 9th.

For ten days of the period that she was in the cast she attended the horse races daily. (We should have collected our fee before the ponies did!)

The cast was worn until September 8th, when it was removed. One week later she returned for observation. There were no pain and no limitation of motion. She was discharged as cured.

The final diagnosis was traumatic anterior rotary dislocation of the right lateral mass of the atlas to the right.

CASE II. R. M., white male, aged ten years, was admitted to the Ohio Valley General Hospital on September 12, 1928. He gave a history of wrestling with his brother three days previously, during the scuffle developing severe pain in his neck and noticed that he could not move his head.

Examination revealed that the chin pointed to the right with tilting of the head to the left side. All attempts at motion were painful. There was no rotation to the left and very little to the right. The spinous process of the axis was to the right of the midline.

X-ray examination revealed a narrowing on the left side of the atlanto-axial articulation. The odontoid process was normal. A diagnosis of left rotary dislocation of the atlas on the axis was made.

Laboratory examinations were negative except for a few red blood cells in the urine, which cleared in a few days.

The patient was put on a Bradford frame with a canvas retaining sheet over him. A jury-mast was applied with twelve pounds of weight, and a small pillow was placed under the neck. Six days later he was able to rotate his head normally. The extension was continued two days more. A plaster cast was applied on September 20, 1928, from the waist to the top

of the head. This was done with the patient sitting on a stool and the head held in extension with a jury-mast. The patient was discharged from the hospital two days later with permission to be ambulatory. The cast was removed six weeks later. All symptoms had disappeared. Range of motion was normal and no pain was present. The patient was discharged as cured.

Case III. Mrs. R. C., a white female, aged fifty-six years, came to the Clinic on September 29, 1928, with complaints of severe pain in the back of the neck, swelling of the right side of the neck and inability to move the head, existing for six months. It developed immediately after turning a somersault in the gymnasium. Numerous chiropractic adjustments had been given during this period without any relief.

The past history was negative except for extraction of some abscessed teeth in 1925 and some difficulty with the left eustachian tube in 1926.

Physical examination revealed a rather nervous female with the typical deformity of the head and neck of a rotary dislocation of the atlas. The chin pointed to the right with tilting of the head to the left. The spastic cervical muscles formed the swelling on the right side of the neck. The spine of the axis pointed to the right of the midline. All attempts at motion were quite painful. In fact, the patient supported her head with her hands when she attempted to turn the head.

Roentgen ray examination revealed considerable osteoarthritis of all the cervical vertebra. There was some narrowing of the intervertebral disc on the left side with apparently some displacement of the atlas to the right.

A diagnosis of anterior rotary dislocation of the left lateral mass of the atlas on the axis with hypertrophic osteoarthritis of the bodies of the cervical vertebra was made.

The patient was placed on a Bradford frame with a small pillow under the neck. A jury-mast was applied with fifteen pounds of traction which was increased to twenty pounds. Reduction was completed in ten days, and a head and body cast was applied. She was discharged from the hospital in twenty days. The period in the hospital was rather stormy as she had a great deal of pain, was nauseated, vomited frequently, was quite nervous, and did not sleep well.

Three weeks later the cast was removed and daily baking and massage were instituted by a physiotherapist. She returned in ten days for observation. There was no limitation of motion, and there was a marked improvement in the intensity of the pain.

The patient was observed for several years. There was never any recurrence of the deformity, but she continued to have some pain, which was unquestionably due to the arthritis.

Case IV. D. B., white female, aged nine years, was referred to the Wheeling Clinic on April 29, 1930, for heart disease and inability to turn the head. Attention was also called to a painful lump just to the left of the spinal column at the base of the skull.

The history revealed that three years before she had a simple head cold followed by an endocarditis. She was kept in bed for six months. In February, 1930, the thyroid became enlarged, and she lost weight, developed a pulse rate between 140 and 160, and ran a mild febrile course. This condition cleared under treatment by the family physician, although she had not fully regained her normal health. Six weeks before her visit to the Wheeling Clinic she was knocked down in the schoolyard. The deformity of the head and neck immediately followed this accident.

Examination revealed the typical deformity. The chin pointed to the left. There was no rotation to the right. There was some limitation of motion in opening the mouth. The left sternocleidomastoid muscle was tense. Forward and backward motion of the head was present but somewhat limited. There was a tumor mass about one inch in diameter just to the left of the midline posteriorly below the occiput. This swelling had been treated as an enlarged gland. The tonsils were grossly infected. There was a loud systolic murmur heard best at the apex of the heart.

Roentgen ray examination revealed rotation of the atlas on the axis with narrowing of both intervertebral spaces.

This was unquestionably a case of rotary dislocation of the atlas in a patient whose general health had been undermined by an upper respiratory infection followed by an endocarditis and a thyroiditis. Probably the ligamentous structures of the atlanto-axial articulation had been weakened as a result of her infection, and the actual dislocation followed the injury in the school-yard. Due to the

lack of finances the child was not admitted to the hospital until May 29, 1930. She was immediately placed on a Bradford frame with a retention canvas sheet over her. Head traction of fifteen pounds was applied. Reduction did not take place. Manipulation by the Walton method was tried but was unsuccessful.

On July 7, 1930, an open reduction was attempted. The vertebra were exposed and the dislocation was plainly demonstrated. The right side was completely dislocated anteriorly and the left posteriorly. During the manipulation a hemostat on a branch of the vertebral artery made a rent in its wall, a large amount of blood being lost before bleeding could be controlled. The wound was packed with the hemostats in place and a blood transfusion was given immediately. The clamps were removed on the fifth day and the wound closed. Extension with a jury-mast was reapplied. Reduction seemed to be complete a week later. A head and chest cast was then applied with the patient supine on the Albee table, with the spinal support being used as previously described and the head being held in extension with a muslin jury-mast. This was worn for two months. On removal of the cast the patient felt fine, has gained in weight, and had practically normal range of motion. What limitation she had was in rotation to the right.

The difficulty in reduction in this case was probably due to the fact that there was dislocation of both lateral masses of the atlas for a period of four months. I believe the explanation for the reduction which was accomplished in seven days after the closure of the wound is to be found in the fact that many of the ligaments and muscles in this region were severed at operation. The tumor which was supposed to be an enlarged gland to the left of the midline was the left lateral mass of the atlas.

Case v. E. D., a white male, aged three years, was referred to the Wheeling Clinic on May 28, 1934, with the complaints of pain in the neck, inability to turn the head, and limitation in opening the mouth.

The mother gave the history that two weeks before admission he had fallen from a porch roof, alighting on his head. The child had eaten very little, cried most of the time and there had been no improvement in his condition since the accident. There was no history of any antecedent disease.

On examination the child presented the typical symptoms of a rotary dislocation of the atlas. The chin was turned to the right with a tilt of the head to the left. Any attempt at rotation caused severe pain. There was complete limitation of rotation to the left. It was interesting to note that the child tried to hold his head with his hands when he sat erect. Due to the extreme irritability of the child and the tenderness of the neck it was impossible to palpate the spine of the axis.

Roentgen ray examination was unsatisfactory except that we were able definitely to eliminate any fracture.

A diagnosis of an anterior rotary dislocation of the left lateral mass of the atlas on the axis was made, and the patient was sent to the hospital. He was put on a Bradford frame with a retention jacket and extension applied with a jury-mast and eight pounds of traction. In a few days his disposition improved, he cried very little and ate much better. On June 3rd the dislocation seemed to be reduced, but the traction was left on until June 5th, when a head and chest cast was applied. This was done with the child supine on the Albee fracture table, being supported by the spinal bar. The head was held in hyperextension by a muslin halter. He was permitted to walk the next day and was discharged on June 7th. The child walked and played as usual. On July 6th he returned to have his cast removed. There was no pain or deformity, and he had a perfectly normal range of motion. He was seen several months later at which time he was still normal and had had no untoward symptoms.

Case vi. R. T., a white male, aged thirteen years, was brought to the Wheeling Clinic on June 18, 1934, with the complaint of pain at the base of the skull on the left side and inability to rotate the head.

The patient gave a history of having had a boxing bout with his younger brother the preceding day. During the affair the younger brother landed a punch on the left side of the neck with the immediate appearance of the deformity that was observed on admission.

Physical examination revealed the usual deformity. The chin pointed to the left and the head was tilted to the right. There was no rotation to the right and very little to the left. The spine of the axis was palpated to the left of the midline.

Roentgen ray examination revealed a normal intervertebral space between the atlas and axis on the left but almost complete obliteration on the right. The odontoid process was normal.

The clinical diagnosis was, of course, corroborated in this case. It was an anterior rotary dislocation of the right lateral mass of the atlas on the axis.

The patient was hospitalized for extension with a jury-mast on a Bradford frame. A small pillow was placed under the neck for hyperextension. He was soon comfortable on the frame. The dislocation was reduced in about five days, but extension was left on until June 25, 1934. The usual head and chest cast was then applied. The patient sat on a stool with the body held erect and the head in hyperextension with a jury-mast.

He was discharged from the hospital on June 26, 1934. During the six weeks period in which he wore the cast the patient enjoyed all his former activities. After the cast was removed the neck was massaged for a short time. Motion was normal, there was no deformity or pain, and within a few days he was discharged as cured.

This patient had a partial recurrence on the same side eight months after the original injury. He sustained a minor injury to the neck in a skiing accident and while still complaining of a stiff neck he was struck in the neck. The difficulty previously described reappeared immediately. On careful examination it was evident that the condition was not quite so severe the second time. The head was tilted and rotated in the same manner as previously. Only slight movement of the head was possible, and the most marked limitation was in rotation to the right. Reduction was very easily and successfully accomplished in twenty-four hours by extension with the jury-mast. This recurrence was definitely due to a second trauma and probably bore no direct relation to the original injury.

Case vii. Miss D. S., a white female, aged twenty-three years, was first seen October 27, 1934, complaining of severe pain in her neck, inability to rotate the head, and difficulty in opening her mouth.

She gave the history that in the morning she had gone to work with a slightly painful stiff neck. During the morning while standing with her left side to a cabinet, she suddenly looked at a higher cabinet to the left when she experienced a sudden click in her neck, accompanied by a severe pain. Immediately she noticed that her head was locked with the chin pointing to the left. She consulted a chiropractor, but apparently his manipulations were as painful as they were fruitless.

When seen she was almost hysterical and all motions of the head were assisted by her hands. The typical position of the head was present with rotation of the chin to the left. Rotation of the head to the right was impossible, and she could open her mouth only a short distance.

A diagnosis of rotary dislocation of the atlas was made, and the patient was sent to the hospital. The *x*-ray revealed a narrowing of both intervertebral spaces of the atlanto-axial joints. The odontoid process was not fractured. The spine of the axis was seen pointing to the left of the midline. The dislocation was an anterior rotary dislocation of the right lateral mass of the atlas.

The patient was placed on a Bradford frame with a jury-mast on the head with fifteen pounds of traction. The dislocation was reduced in three days. On November 1st the head and chest cast was applied with the patient sitting on a stool with a jury-mast on the head. Extension was made with a block and tackle attached to the ceiling. She was walking around comfortably at the time of discharge from the hospital on November 4th.

The patient was readmitted to the hospital on December 12th for removal of the cast. She remained for four days to have physiotherapy. On discharge she was free of pain and had normal range of motion.

Case viii. H. L., a white male, aged twelve years, was sent to the hospital on November 23, 1934, by the family physician. The chief complaints were pain in the neck and inability to move the head. He gave a history of having been struck on the head and neck while playing basketball on the day of admission.

Examination revealed the chin pointing to the left with a tilt of the head to the right. There was no rotation to the right and very little to the left. He was able to open his mouth only a short distance, and there was tenderness on both sides of the neck posteriorly in the region of the axis.

Roentgen ray examination revealed some displacement of the atlas to the right with slight narrowing of the atlanto-axial articulation on

the right side. The spine of the axis was seen to the left of the midline.

A diagnosis of anterior rotary dislocation of the right lateral mass of the atlas on the axis was made. The patient was placed on a Bradford frame with a retention sheet over him. Extension was applied with a jury-mast and twelve pounds of weight. Reduction was obtained in a week, but the extension was permitted to remain for ten days. A plaster cast was then applied to the head and chest while the patient was sitting on a stool with the head extended by a jury-mast. He was discharged as ambulatory on December 2, 1934. Six weeks later he returned for removal of the cast. There was no pain, and all motions were normal. He was discharged as cured.

Case IX. E. M., a white male, aged fifty-one years, came to the Wheeling Clinic on December 3, 1934, with the complaints of pain in the base of his skull and neck and inability to move his head. He gave the history that seven weeks previously he had been in an automobile accident in which the car turned over several times but at that time he did not realize that he was hurt. However, a few hours later he could not turn his head and a severe pain developed in his neck. He had some treatment without relief. The limitation of motion of the head had been continuous since the onset a few hours after the accident.

Examination revealed the chin pointing to the left with tilting of the head to the right. There was complete limitation of motion in every direction. Tenderness was most marked on the right side of the neck at the base of the skull.

Roentgen ray examination revealed a fracture of the right lateral mass of the atlas, narrowing of the intervertebral space on this side, with anterior displacement of the right lateral mass.

A diagnosis of anterior rotary dislocation of the right lateral mass of the atlas on the axis with fracture of the right lateral mass was made. The patient was placed on a Bradford frame with a jury-mast on the head with twenty pounds of weight for traction. He was quite uncomfortable the first two days, but each succeeding day he felt better. Reduction was completed and a head and chest cast was applied on December 10th. The patient sat on a stool with extension by a jury-mast while the cast was applied. He was quite comfortable in the cast and was soon able to walk normally. He was discharged from the hospital on December 17th.

Two weeks later he returned to the Wheeling Clinic feeling fine and stated that he was driving a car every day. The top of the head portion of the cast was removed.

On February 8, 1935, the patient returned and the remainder of the cast was removed. *X*-ray films revealed the atlas to be in good position and a fair amount of callus was seen in the fracture. Several letters from the patient have been received since that time. He reports that he is doing his regular work, has no pain, and has normal range of motion.

CONCLUSIONS

1. Simple rotary dislocation of the atlas on the axis is not as infrequent as might be supposed.

2. The causative factor is usually a very mild form of trauma.

3. This condition presents a typical deformity which is readily corrected by simple traction or manipulation but to insure good results should be retained in position by a head and chest cast for a period of six to eight weeks.

4. Verification of the diagnosis by *x*-ray is impossible in some cases, due to the difficulty of getting good pictures in the presence of the painful deformity.

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[SCIATIC NEURALGIA]

CONTROLLED BY INTRASPINAL (SUBARACHNOID) INJECTIONS OF ETHYL ALCOHOL

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INTRACTIBLE pain has been adequately relieved by the subarachnoid injection of 95 per cent and also absolute alcohol. Malignant growths of the pelvis and abdomen, involving sensory nerves with pain, have been the first condition to invoke the use of alcohol in this manner. It is generally conceded that we may resort to any method for relieving pain caused by a condition which will result eventually in death irrespective of any treatment. In these instances alcohol has been used even in the absence of sound experimental evidence to the effect that no permanent damage was done to the nerve structures or to the dura mater of the spinal canal at the site of injection.

Sicard, Reding, Van Erps and Dogliotti all reported cases; Abraham, Greenhill and Schmitz, together with Yeomans, Saltzstein and Stern have been instrumental in a fuller development of the idea. Then came the more conclusive work from the University of California by Aird and Naffziger, in which they show experimental evidence of the neuropathological changes incident to root involvement, motor, sensory and sphincter alterations and the more important findings of the comparatively small margin of safety for effective doses of ethyl alcohol when used in this manner.

The conclusions of all workers appeared to warrant the trial use of absolute alcohol introduced into the subarachnoid space for the relief of sciatic neuralgia. Selected cases were used in which pain of a definite funicular origin was established beyond a doubt. This included funiculitis due to root pressure produced by hypertrophic arthritic changes about foramina, involving lumbar and sacral roots; postural changes accompanied by anomalies of vertebra with similar pain, unrelieved by other methods; chronic back strains in which the sciatic neuralgia proved intractible. A few peripheral sensory nerve involvements because of malignant growths within the pelvis and the abdomen were included, all with relief. These, however, are not included in this report. An ordinary spinal needle was introduced into the subarachnoid space at the level of the root most involved, generally the fifth interspace in the lumbar region. Procaine injected into the skin beforehand is not necessary. Spinal fluid is obtained indicating the needle is just within the subarachnoid space. The patient is then placed on the side opposite the extremity suffering pain, with a sandbag under the loin and hip to raise this point higher than any other part of the spinal canal. The head is flat on the side without pillow; from 9 to 16 minums of alcohol are allowed to enter the canal, drop by drop, consuming at least three minutes in the process. This permits the alcohol to rise at once because of its lighter specific gravity, 0.806, where spinal fluid has a specific gravity of 1.007, and form a puddle around the desired root directly above the point of the spinal needle. The sensory nerves are in the posterior spinal roots, the majority of which are not myelinated or but slightly so, in contradistinction to motor roots. The patient is slightly pronated forward to place the posterior roots a bit higher than the motor roots. The two roots, motor and sensory, are so close together as they approach the foramina, even before the sensory fibres reach their ganglion, that the puddle of alcohol must, of necessity, bathe the motor fibres to a certain extent.

The reason there is not a motor depression with paralysis is accounted for by the fact, in my opinion, that motor nerves are

Fig. 1. Position of patient at time of intraspinal injection. Note that needle, in 5th interspace, is at highest level of cord, trunk flexed laterally over sand bag.

myelinated and well protected, offering great resistance to the cautery action of alcohol. No attempt is made to mix the fluids by withdrawing part into syringe. This action is of course not desired. The needle is withdrawn and the patient kept in this position for thirty minutes watched by an attendant, before he is allowed flat on his face for two hours. He is permitted to leave the hospital four hours later.

Identical effects have been observed by all users. The pain is instantly relieved and a sense of warmth with some numbness following, is the rule. This includes the whole extremity. Patient can always move extremity though it may continue to feel "asleep" for several days. Occasionally the pain returns for a few days but always disappears within two weeks of the injection. The recurrence of the pain is never more than a part of the original neuralgia. Patients are generally immediately relieved. To account for this phenomenon, Lugaro's concept of the relief of neuralgia aptly applies. All the sensory neurons cannot be blocked because the alcohol probably reaches only a portion of them. He believes, that blocking only a number of sensory tracts is sufficient; of course that number must be greater in proportion to the pain. The fact that the patient feels a sense of warmth followed by numbness and occasionally a sense of feeling akin to pouring warm water over leg, points toward the theory of pain conductivity

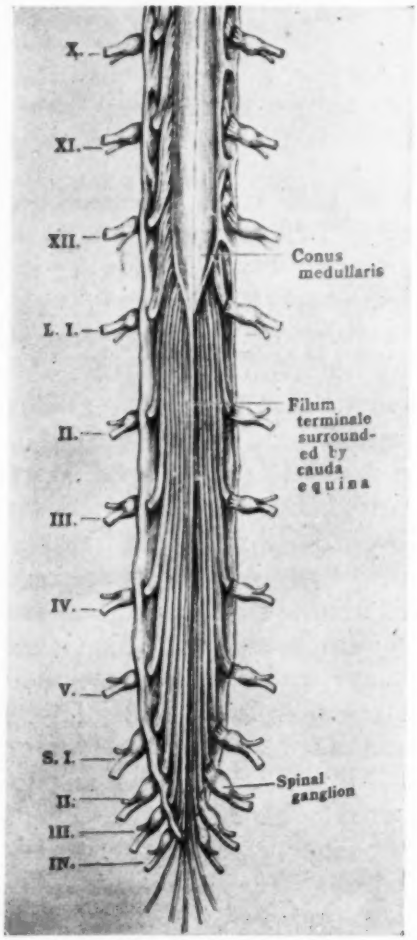

Fig. 2. A clearer idea of position of nerve roots of the cauda equina than used in former articles. Dura mater has been split open in illustration.

along fibres of heat, cold, pressure and touch and not via a separate system of neurons.

CONCLUSIONS

The uniformity of results reported seems to indicate a possibility of this procedure replacing, to a greater extent all major procedures, such as chordotomy, rhizotomy and sympathectomy. Its abuse will bring discredit, which is possible because of the simplicity and range of application. Further use along controlled lines is indicated. The comparatively small safety factor, shown by recent workers, calls for strict

SCIATIC NEURALGIA
Controlled by Intraspinal (subarachnoid) Injection of Ethyl Alcohol

	Analysis of Results													Complications			
Case Number	Am. Absolute Alcohol	Amt. 95 Per Cent Alcohol	Relieved at Once	Relieved Same Day	Recurred Same Day	Recurred in 1 Week	Recurred in 2 Weeks	Entirely Relieved in 3 Weeks	Entirely Relieved in 4 Weeks	Recurring Attacks	Bilateral Injections	Second Injection	Urinary Retension—24 Hours to 3 Days	Rectal Retension—1 to 5 Days	Motor Changes	Unusual Sensory Changes
1		.9 c.c.		x	x			x					x			
2		.9 c.c.	x					x					x			
3		.8 c.c.	x					x								
4		.6 c.c.		x		x		x			x					
5	.8 c.c.		x					x								
6	.9 c.c.		x					x					x			
7	1.0 c.c.		x					x					x			
8	1.0 c.c.		x					x					x			
9	.9 c.c.		x					x								
10	.4 c.c.			x			x	x		x		x				
11	.9 c.c.		x					x								
12	.6 c.c.			x				x								
13	.9 c.c.		x					x		x						
14	1.0 c.c.		x				x		x				x			
15	1.0 c.c.			x			x		x							
16	.9 c.c.		x					x								
17	.8 c.c.		x					x								
18	.9 c.c.		x					x								
*19	.8 c.c.		x			x		x		x			x	x		x
20	1.1 c.c.		x					x					x			

* Ober operation after second attack with complete relief.

adherence to proved technique. At last we have some hope that a simple, useful procedure is at hand for the temporary relief of sciatic neuralgia. Corrective exercises and muscle building can then be applied, in many cases, to overcome most of the causes of this type of pain and a permanent cure obtained.

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INTRAPERITONEAL USE OF AMNIOTIC FLUID TO PROMOTE SMOOTHER POSTOPERATIVE CONVALESCENCE*

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A POSTOPERATIVE convalescence which should be smooth and uneventful is frequently made stormy by nausea, vomiting, distention and gas pains. These are a source of annoyance to the patient varying from discomfort to excruciating pain; to the surgeon they are the possible forerunners of dangerous complications.

On the Gynecological Service at Bellevue Hospital the usual treatments for these conditions have failed to give uniformly good results. In an attempt to solve the problem, recent literature was reviewed for suggestions as to prevention and treatment, and it was found that Johnson[1] in 1928 and Trusler[2] in 1931 had reported some interesting facts. During their independent studies of amniotic fluid as a modifier of peritoneal adhesions, they observed that the patients and experimental animals receiving amniotic fluid intraperitoneally at the time of operation, had a smoother convalescence. The preparation used for intraperitoneal use of amniotic fluid was "amfetin," (Lilly), a concentrated sterile fraction of bovine amniotic fluid. The source, collection and preparation of this concentrated fraction is amply discussed in a recent article by Johnson.[3]

The clinical work on amfetin was preceded by a small series of control experiments with dogs weighing from 10 to 15 kilograms. In each case the peritoneal cavity was entered through a right rectus incision, the parietal peritoneum, stomach and intestines scarified with a sharp scalpel and several pieces of peritoneum 1 cm. wide and 5 cm. long stripped off adjacent loops of intestines. The whole traumatized area was then liberally swabbed with half strength tincture of iodine, after which 100 c.c. of amfetin were introduced into the peritoneal cavity of the experimental animals and an equivalent amount of normal saline into the controls, incision in both cases being closed in layers. Morphine hypodermically followed by inhalation ether were used as anesthetic agents. The peritoneal cavity was opened in each case three weeks after operation and results carefully tabulated. The animals treated with amfetin withstood an average of two and one-half such operations before death, while the controls withstood an average of one and one quarter operations. Our observations on adhesions in these animals coincided with Lacey's[4] views; following the initial operation the adhesions in the treated animals were almost as numerous as in the controls but were definitely less dense and easier to separate. Repeated separation of adhesions followed by the use of amfetin, each time resulted in fewer and thinner adhesions, while in the controls the adhesions became more numerous and denser.

The general appearance of the treated animals was uniformly and obviously better than that of the controls; the animals in the former group were more active, had a more normal posture, and evinced a normal appetite sooner than the controls. It was concluded from this small series that the intraperitoneal use of amfetin was safe and possibly beneficial.

The clinical use of amfetin was then begun. It was used entirely at the time of

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operation, the technique of administration being briefly as follows: The fluid was heated in the stock bottle to 100°F., the cap and neck of the bottle then wiped off with alcohol, the cap removed and the fluid introduced into the abdomen through a funnel, immediately preceding the tying of the last peritoneal suture. The amount used varied from 200 to 400 c.c. In most cases the latter amount was found to be the optimum. It was advantageous to have the patient in Trendelenberg position during the instillation.

The present study was conducted on the Gynecological Service at Bellevue Hospital, where there is a predominance of extensive and severe pelvic pathology such as is not encountered to any extent in the usual hospital patient. This fact is mentioned only to emphasize our belief that any favorable results obtained should be interpreted liberally, because of the primary handicap imposed by the type of pathology encountered at operation in treated cases.

Of 100 consecutive laparotomies, the 50 patients showing the most marked pelvic pathology at the time of operation, were selected for treatment with amfetin. The remaining 50 of the series were used as controls. The surgeons for the most part were the same, so that no question of individual ability need arise. The anesthetist, anesthetic agent, preoperative preparation and postoperative nursing care were essentially the same in both groups. The series of treated patients includes three deaths, which will be discussed later. The results obtained in the cases given amfetin were analyzed and compared with the controls in the following tables.

In Table I the diagnoses in the two groups of patients are compared, but does not take into account the complicating factors, notably adhesions, which were found at operation. It will be noted that there is a preponderance of adnexal pathology in the amfetin group, whereas 50 per cent of the control group is composed of uncomplicated uterine fibroids.

In Table II the operations performed in the two groups are compared. It will be seen from this table that, anatomically speaking, the types of operations in the two groups were very similar.

TABLE I
DIAGNOSES

	Amfetin	Control
Retroversion uteri and chronic adnexal	5	2
Old ectopic	3	0
Carcinoma of ovary	3	1
Postoperative adhesions and chronic adnexal	2	1
Chronic adnexal	15	8
Fibroid uterus	9	25
Fibroid uterus and chronic adnexal	10	4
Ovarian cyst	3	5
Ectopic	0	3
Carcinoma of fundus	0	1

TABLE II
OPERATIONS

	Amfetin	Control
Suspension of uterus	2	6
Supracervical hysterectomy	3	2
Supracervical hysterectomy and unilateral salpingo-oophorectomy	5	8
Supracervical hysterectomy and bilateral salpingo-oophorectomy	13	19
Bilateral salpingo-oophorectomy	6	1
Unilateral salpingo-oophorectomy	13	4
Unilateral salpingectomy	4	3
Turpentine injection of tubes	3	1
Exploratory laparotomy	1	2
Myomectomy	0	3
Sovak reconstruction	0	1
	50	50

TABLE III
ADHESIONS

	None Per Cent	Fine Per Cent	Moderate Per Cent	Dense Per Cent	Total with Adhesions Per Cent
Amfetin	12	4	10	74	88
Control	64	16	10	10	36

In Table III the extent and density of adhesions found at operation in the two

groups are compared. Of the cases given amfetin 80 per cent had adhesions present, while only 36 per cent of the controls were thus complicated and these to a much less extent, while 74 per cent of the amfetin group had dense adhesions only 10 per cent of the controls were similarly complicated. From this analysis we would expect a much smoother postoperative convalescence in the control group, for operation on the amfetin group definitely entailed more extensive and more traumatic surgery.

TABLE IV
GENERAL DATA

	Amfetin	Control
1. Average age of patient	35	37
2. Average operation time	52 Minutes	56 Minutes
3. Average postoperative day of voiding	2.25	3.1
4. Average postoperative blood pressure	98/67	108/70
5. Average postoperative complications	18 per cent	12 per cent

In Table IV is presented general information, as to the average age of the patients in the two groups, average operating time, postoperative day of voiding, postoperative blood pressure and a comparative percentage of postoperative complications. Wound infections in both groups were the same, all being superficial but one, a deep intramural abscess occurring in a control case. In the amfetin cases 4 patients had bronchitis, 2 pneumonia, and one each of hemolytic septicemia, pyelitis and general peritonitis, making a total of 9 complications or 18 per cent. These include the 3 deaths mentioned. In the control cases there were 2 pneumonias and one each of intestinal obstruction, bilateral otitis media, thrombophlebitis of the leg, and sinus tachycardia, making a total of 6 or 12 per cent.

In Table V is compared the average temperature and pulse rate for each of the first four postoperative days, reactions being less in the amfetin group. This was probably due to an early return of the normal motility of the gastrointestinal tract, plus repression of any low grade peritoneal infection. Following the work of Young and Marks[6] the latter explanation seems more feasible.

TABLE V
TEMPERATURE AND PULSE FIRST FOUR POST OPERATIVE DAYS

	Amfetin		Control	
	Temperature	Pulse	Temperature	Pulse
1st 24 hours	99.6	99	100.2	106
2nd 24 hours	100.8	101	102.2	114
3rd 24 hours	100.7	102	101.0	104
4th 24 hours	100	97	100.3	103

TABLE VI

NAUSEA			VOMITING		
	Amfetin Per Cent	Control Per Cent		Amfetin Per Cent	Control Per Cent
Slight	32	28	Slight	30	22
Moderate	6	22	Moderate	4	22
Severe	2	6	Severe	2	6
Total	40	56	Total	36	50

DISTRIBUTION			GAS PAINS		
	Amfetin Per Cent	Control Per Cent		Amfetin Per Cent	Control Per Cent
Slight	26	38	Slight	22	22
Moderate	6	11	Moderate	14	50
Severe	2	22	Severe	2	11
Total	34	71	Total	38	83

In Table VI is compared the amount of nausea, vomiting, distention and gas pains in the two groups of patients. It may be well to stress the fact that though the "slight" columns of both groups are

similar, the "moderate" and "severe" columns show a marked contrast, favoring the amfetin group. This would seem to indicate that amfetin prevents the occurrence of the usual percentage of "slight" complaints and decreases the severity of those "moderate" and "severe" cases to the point where they fall under the "slight" classification. This is shown by the fact that while the average of the "slight" columns in the amfetin and control groups is 27.5 per cent, in the "moderate" column the average of the amfetin group is 7.5 per cent and under the control it is 26 per cent; in the "severe" column of amfetin the average is 2 per cent and in the controls, 11.5 per cent.

In addition to these tabulated facts it has been definitely established that the patients receiving amfetin were able to take and retain fluids and food earlier and in larger amounts than the control group. They were also able to void and pass flatus earlier, unassisted by the usual methods. The amfetin group in many ways seemed happier and in better general condition than did the controls. It was also observed that the postoperative posture of the patients in the amfetin group approximated more nearly normal than did the control patients. The hospitalization period was the same in both groups due to the hospital routine, but the amfetin group desired to be out of bed sooner, in spite of the fact that they had been subjected to more extensive surgery than had the control patients. During the course of clinical observations on amfetin, in 6 patients operated, 400 c.c. sterile saline solution were introduced into the peritoneal cavity, to determine whether the results obtained with amfetin might be due to the presence of a fluid in the peritoneal cavity. The reaction of these patients was no different than that of a similar group of patients having the same type of operation, followed by a hypodermoclysis of 400 c.c. of normal saline.

The three deaths which occurred in the amfetin group were as follows:

Case I. Colored female, age thirty-eight, was in the hospital twenty-eight days preoperatively with fourteen consecutive days of normal temperature, pulse and blood work. A fibroid uterus and chronic adnexal disease necessitated a supracervical hysterectomy, bilateral Salpingectomy, and a left Oophorectomy. A fibroid uterus, size of twenty-four weeks gestation and a left pyosalpinx were found. At the time of operation 400 c.c. of amfetin were introduced into the peritoneal cavity. The patient ran a septic temperature and expired seventy-two hours later. Blood culture taken twenty-four hours postoperatively was positive for hemolytic streptococcus. There were no signs of peritonitis. Postmortem abdominal tap was dry. There was no nausea, vomiting or distention until two hours antemortem. No autopsy was obtainable.

Case II. Colored female, age thirty-two with diagnosis of fibroid uterus and chronic adnexal disease was operated doing a supracervical hysterectomy and bilateral salpingo-oophorectomy, introducing 400 c.c. of amfetin at the time of operation. Patient died on the fourth postoperative day of a right middle and lower lobar pneumonia. Blood culture was positive for type V pneumococcus. There was no nausea, vomiting or distention until the day of her death.

Case III. White female, age thirty-seven, admitted with a draining colpotomy wound of two years duration. This was healed by local treatment and patient sent for two months rest. She was readmitted with a history of constant vaginal bleeding and pelvic pain of six weeks duration. Temperature, pulse and blood count were normal in spite of repeated pelvic examinations. At operation, the entire pelvis was found to be filled with intestines, fibroid uterus and tubo-ovarian masses, all bound together by numerous bands of dense adhesions. The adhesions were separated, and a supracervical hysterectomy and bilateral salpingo-oophorectomy was performed. The odor of pus was detected at operation, but its source could not be located. Prior to abdominal closure 400 c.c. of amfetin were introduced. The patient developed general peritonitis and died on the fourth postoperative day. Autopsy revealed acute general purulent peritonitis, numerous filmy adhesions being seen throughout the abdomen. No evidence of amfetin was found. Nausea, vomiting and distention were pro-

nounced during the most of her postoperative period.

This is only a preliminary report, as the study is being continued. We hope to report a larger series of cases, with laboratory work to supplement the study.

CONCLUSIONS

1. A concentrated sterile fraction of bovine amniotic fluid (Amfetin, Lilly) can safely be employed intraperitoneally following abdominal surgery.

2. When so used it promotes a smoother postoperative convalescence, with less nausea, vomiting, distention and gas pains.

3. The optimum amount to be used in the average case is 400 c.c.

4. It should not be used at the time of operation if the presence of pus is suspected.

5. It definitely hastens the patient's return to normal physical activity.

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* *Continued from p. 17.*

TREATMENT OF SPRAINS BY INTERLIGAMENTARY INJECTION OF NOVOCAINE

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DURING the last few years we have treated all mild sprains by the interligamentary injection of novocaine with consistently excellent results. The traumatized joint usually responds quickly to treatment, often requiring but a single injection, and we find that the relief is permanent. Since we believe that we are able to effectively suppress the troubles which lead to prolonged functional weakness of a joint, we present this short discussion based entirely upon our clinical experiences and observations.

THEORETICAL BACKGROUND

Many classical treatises dismiss a sprain in vague terms as the consequence of a sudden, exaggerated execution of articular movements. This may explain how a sprain is produced but to us the important feature is why there is functional impotency of the articulation. In many cases a sprain is accompanied by torn ligaments or possible fracture, either of which if present, adequately explains the functional disability. *X*-ray examination should be employed to establish the presence or absence of fracture, and occasionally ligamentary displacements or tears if present can be discovered while cleaning a superficial wound. It is our belief however, that many and perhaps most of the common sprains do not involve an actual ligamentary tear. Why then, do we so often find serious functional troubles following sprains?

Histologically, the articular ligaments are well endowed with sensitive corpuscles. Rauber in 1865, emphasized the rich nervous tissue of ligaments and later studies have shown that they possess as many sensitive corpuscles as the skin. This is logically expected when one recalls that series upon series of automatic regulatory impulses emenate from the rich nervous supply in the region of an articulation.

In sprains the ligamentary trauma is accompanied by a violent excitation of this rich nerve supply; the functional impotence following immediately as a direct consequence. Thus if one suppresses the nerve irritation by means of a local anesthesia of the ligament, the normal functional state is restored. Whence, we conclude "*that a sprain is the reflex consequence of trauma, and specifically the result of a distortion of the nervous apparatus present in the articular ligaments.*"

In cases with edema, local hyperemia and even articular effusion present one may suspect vasomotor troubles as a cause, whereupon careful vascular examination is indicated. Thus, this new conception of a sprain has led us to try the treatment of interligamentary injections with surprising results.

TECHNIQUE

(1) Injection of 10 to 20 c.c., according to the importance of the articulation, of a 1 per cent solution of novocaine in the region of the traumatized ligament. The point designated for the injection is the spot of maximum tenderness but care is also taken to inject the ligament itself.

(2) Material ordinarily used for local anesthesia; a fine needle and an ordinary syringe.

(3) Ligaments of the knee, wrist, ankle and shoulder are usually easy to locate. For the hip, however, the injection is more

difficult. For this articulation one succeeds in avoiding the large vessels by introducing the needle to the neck of the femur, withdrawing it about 1 cm. and then making the injection. The use of a fine, long, flexible needle facilitates the injections, allowing one to surround the osseous tuberosities, thus obviating the necessity for repeated skin punctures.

(4) The results are immediate and the attempts of the patient at mobilization in the first quarter of an hour indicate if the injection is sufficient. If the pain and disability still persist, another injection in the region remaining painful is made, so that the total quantity injected does not exceed 25 or 30 c.c. After several moments the patient is asked to gently move the joint and quite generally he is astonished to find an almost normal painless movement. Cautiously at first, the patient later moves without hesitation when he no longer feels pain. Ordinarily a single injection suffices, but if not, repeated infiltrations during the subsequent few days are made.

(5) Accidents in using this technique have never caused alarm, for the puncture of a blood vessel, which should rarely happen, is quite harmless. In order to be certain that novocain is not injected into a vessel one must withdraw the plunger of the syringe, or be certain that no flow of blood comes from the inserted needle. Injections into a joint cavity likewise incurs no risk providing one has observed the rules of strict asepsis. We should however, mention one feature: the patient should always be warned to expect increased pain about one to two hours following injection. This is caused by the increase in blood supply to the tissues infiltrated with novocaine, but it usually disappears in a short time, and leaves the articulation free from pain.

INDICATIONS

We have used this method of treatment in all types of ligamentary sprains in which no fracture or torn ligament could be demonstrated. Sprains may be treated at all stages of development, but the results are more satisfactory in the early stages; older sprains given only inconstant results. We have divided the conditions in which this method of treatment, in our hands, has given good results, into three groups:

(1) Those patients who have an *articular impotence as the result of a sprain* in which there is no fracture, as demonstrated by *x*-ray examination, and where no torn ligaments can be identified. It has been our experience that ligamentary tears can be recognized by the presence of abnormal articular laxity. If these cases of mild sprain are infiltrated during the hours immediately following the accident there is a lasting relief of symptoms with only one or two injections in the first twenty-four hours. Hydrarthrosis or a slight local ecchymosis without fracture is not a contra-indication, and usually there is neither atrophy nor edema as a result of the injections.

(2) *The after-effects of sprains*, namely pain and muscular atrophy, may also be treated by this method. These phenomena disappear with the infiltration of the ligament, and muscular force may be augmented immediately after the injection, as we have noted in a case of sprained wrist by measuring the force of the hand by means of a dynamometer.

(3) *Following joint operations*, in the course of which surgical maneuvers have created what we term an "operation sprain," the infiltration of the strained ligaments will hasten the return of the articulation to normal.

From our clinical experience we believe that most of the common sprains do not involve serious tears of the supporting ligaments, and that infiltration affords a speedy relief of the symptoms which cause prolonged disability and suffering. Hence we have been careful not to include torn ligaments and fragmentary fractures in our category of sprains. In these cases pain is Nature's means of protecting a seriously injured joint, and since we believe that

these cases can be recognized, immobilization should be the treatment of choice. Although not dangerous in itself, the infiltration of torn ligaments or accompanying fractures is not conclusive of results. Its very ineffectiveness, however, may guide one toward a diagnosis of fracture or articular laxity with the increased facility of examination after a local anesthesia. In one case which we have seen, an injured rugby player, whose knee ceased to pain him after infiltration, revealed at the same time a serious articular laxity. Thus in this case we were guided toward a treatment of torn ligaments and not of sprain.

In general this treatment should interest athletes among whom sprains are very common. We believe that a supply of novocaine and the material necessary for its injection should be found in every athletic center. By this treatment, one can easily and at little cost, spare the suffering and time lost for those with sprains.

SUMMARY

As the result of clinical experience and study we have found that the interligamentary injection of novocaine satisfactorily relieves symptoms and speeds the healing of sprains, where no associated fracture or ligamental tear can be demonstrated. This treatment is based upon the conception that local anesthesia of the irritated, complex nervous elements of injured articular ligaments, quickly restores the functional state and greatly reduces the otherwise prolonged convalescence. The technique, results and contraindications are discussed. The best results are obtained in: (1) simple sprains with articular impotence but when no fracture or torn ligaments are found, (2) patients suffering from the after-effects of sprains, namely pain and muscular atrophy, and (3) orthopedic cases where surgical maneuvers may have strained the ligaments about a joint resulting in what we have termed an "operation sprain." This simplified form of treatment should be of special value in athletic centers where sprains are common.

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FASCIA LATA REPAIR OF SLIDING HERNIAS

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ONE of the most difficult hernias to repair because of its peculiar anatomy and physiology, is a "sliding hernia" (Fig. 1) or, as the writer believes it should be called, "prolapse of the colon." In many cases calamities have ensued because of failure to recognize certain cardinal principles underlying the repair of this somewhat unusual condition. A clear concept of the embryology and anatomy of this defect or anomaly is a sine qua non of the armamentarium of one who does a large number of hernias.

In closing an inguinal defect it is desired to obliterate as much of the gap as possible without encroaching too closely upon the cord and its structures, especially the internal and external spermatic and deferential vessels, the pampiniform plexus and the vas deferens. When a "sliding hernia" is encountered, and attempt to utilize the presenting structures is fraught with danger.

When a peritoneal investing layer has a sessile attachment to the posterior abdominal wall, we say the enveloped organ is partly retroperitoneal, as the pancreas or retroperitoneal part of the duodenum. On the other hand, when the peritoneal attachment is narrower, we say that the organ has no mesentery and that it is partly extraperitoneal. Finally, in cases where the organ is almost completely invested so that the two leaflets of the peritoneal sheath are almost in contact posteriorly, one describes the viscus as having a mesentery. (Fig. 1*a*, *b*, *c*.)

The cecum is the commonest offender in "sliding hernias" and may be classed in any of the three divisions; fortunately it is usually in the third class and for that reason we do not see so-called "sliding hernias" so often.

The cecum and appendix often have a complete peritoneal investment, so that they lie free in the right iliac fossa. The usual line of fixation of the ascending colon starts at the beginning of that viscus.

The ileocolic artery supplies the blood to the cecum, the beginning of the ascending colon, appendix and lower ileum. The ileocolic artery arises from the superior mesenteric artery just below the transverse portion of the duodenum and runs downward and dextrolaterally toward the ileocecal angle and divides into four terminal branches:

(1) Anterior cecal, (2) posterior cecal, (3) appendiceal, and (4) ileal artery to lower ileum.

The veins are tributaries to the superior mesenteric trunk.

There are four varieties of prolapse of the colon:

(1) Mobile cecum lying low in pelvis with a relaxed mesentery, and very loose retrocecal and retroperitoneal areolar tissues. (Fig. 2.)

(2) Mobile cecum presenting the same pathology as (1), but the cecum, and even the appendix, enter a preformed open funicular process of the peritoneum in the inguinal canal. (Fig. 2.)

These two classes occur in those with a definite mesentery, as in Figure 1*c*.

(3) A cecum that has a broad attachment resembling mesentery may prolapse enough to present itself at the deep ring.

The sac is incomplete over the unattached area of bowel behind it. This type occurs in those cecums having a broad mesentery, as in Figure 3; and may eventu-

ally become similar to the next class, also Figure 1*b*.

(4) When the prolapse is complete no real sac is present, there is no mesentery the cecum being almost completely extraperitoneal. It slides down extraperitoneally, so to speak, with its serous peritoneal covering intact and presents itself at the deep ring. The bowel may very readily be mistaken for a hernial sac and inadvertently opened. (Fig. 3 and Fig. 1*a*.)

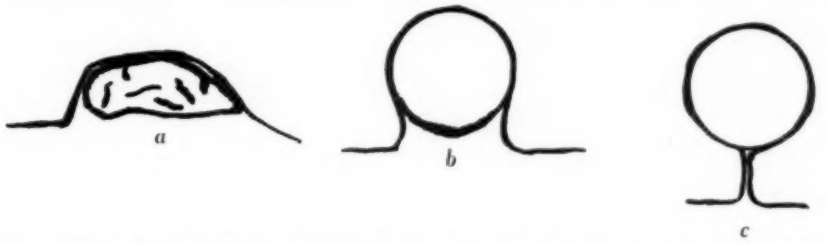

Fig. 1. *a*. Pancreas, retroperitoneal. Some cecums have this attachment. *b*. Ascending colon. No mesentery. *c*. Jejunum. Mesenteric attachment.

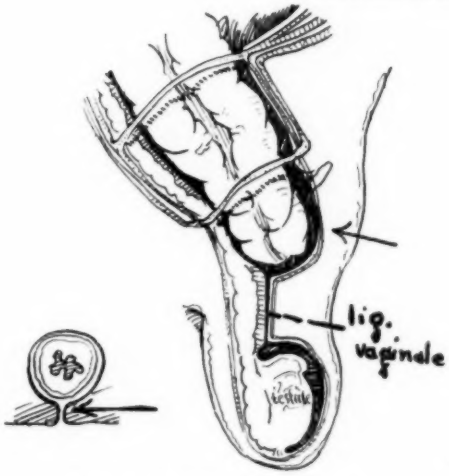

Fig. 2. Cecum in hernia sac.

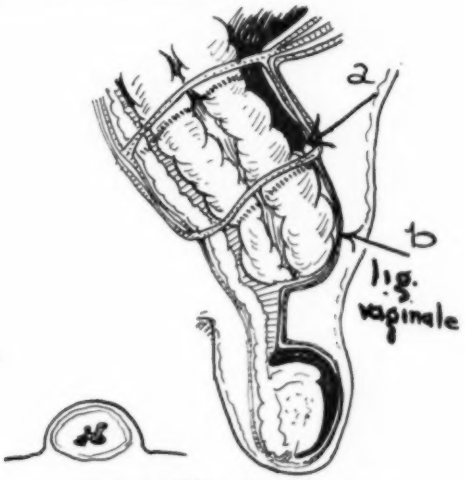

Fig. 3. Sliding hernia; no sac.

In the repair of this condition our attention must be confined to classes 3 and 4.

In class 2, no more difficulty is experienced than in the usual hernia procedure.

In the third type there is a deficiency in the sac posterolateral to the cecal wall, which is presenting. (Fig. 3.) In an attempt to ligate the sac high up, there are two dangers; one is an accidental puncture of the cecal wall (Fig. 1) and, secondly, the more common danger of encroaching on the posterolateral aspect of the cecum as to ligate the cecal vessels. (Fig. 3.)

In the fourth type, an additional hazard is the failure to recognize the cecal bulge as cecum, and believing that a sac is presenting, thus incise or plicate the gut with the expected dire results.

In the past we have been content to reposit the bowel as well as possible and then perform some type of hernioplasty, at the same time being apprehensive lest damage be done to the bowel or cord structures. Consequently, the hiatus at the deep ring was only incompletely narrowed, with resultant postoperative defect. Or shall one say that the original defect was never corrected?

In the appended 7 cases, the following procedure was followed:

After exposing the inguinal canal and mobilizing the structures about the deep ring, a wide strip of the tensor fascia lata was brought up subcutaneously, insinuated through two longitudinal slits of the inguinal ligament, to which it was tacked with a No. 1 chromic single catgut on a Lilienthal needle sutured at the point where it entered the hiatus in the inguinal ligament. (Fig. 4.) The iliotibial band distal to this point was split longitudinally. The lateral segment was tacked with the same type suture and needle to the lowest part of

the mesentery of the cecum and the contiguous deep surface of the upper and lower leaflets of the previously split external

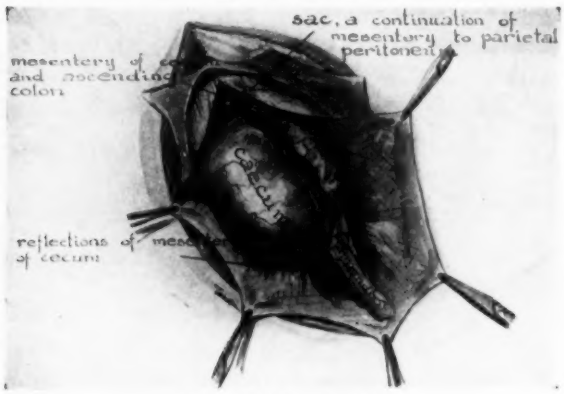

Fig. 4. Sliding hernia.

oblique aponeurosis, including in this suture the conjoined tendon. The medial leaflet of the iliotibial band was then sutured to the upper leaflet of the external oblique aponeurosis and conjoined tendon close to the cord using the same technique. The external oblique aponeurosis was then approximated in the usual manner with nterrupted chronic No. 1 single sutures. (Fig. 4.) The skin of the groin and thigh was then closed in layers.

The same anatomical processes operate in a prolapse of the sigmoid or "sliding hernia" on the left side. A similar procedure is used in this instance.

SUMMARY

To date there has been no satisfactory operative procedure for sliding hernias. In the writer's experience recurrences have been very frequent. Because of the danger of encroachment upon the blood supply a satisfactory repair is difficult. A new procedure is thus devised which has proved satisfactory.

COMMENT

(1) Seven cases of cecal prolapse or so-called "sliding hernia" are presented.

CASE REPORTS

Name and Number	Age	Sex	Previous History	Operation and Findings	Result
(1) M. C.	54	F	Mass in right groin ten years, reducible. Increasing in size lately.	Indirect inguinal hernia, right, with cecal prolapse. Poor musculature.	Excellent
(2) H. S.	64	M	Right inguinal reducible mass fifteen years. Tremendous increase in size recently.	Right indirect inguinal hernia, with cecal prolapse. Myofibrosis of falx aponeurotica.	Excellent
(3) I. C.	62	M	Right inguinal mass ten years. Tremendous increase in size in last five years.	Right indirect inguinal hernia. Cecal prolapse. Bulge in Hesselbach's triangle.	Excellent
(4) S. C.	58	F	Right inguinal mass twelve years. Large increase in last five years.	Right indirect inguinal hernia. Defect in Hesselbach's triangle. Myofibrosis of falx inguinal.	Excellent
(5) A. C.	60	M	Right inguinal mass fourteen years. For past two years has grown to size of an orange.	Right inguinal hernia with bulge in Hesselbach's triangle. Weak musculature. Cecal prolapse.	Excellent
(6) H. A.	65	M	Right inguinal mass fifteen years. Increasing in size.	Right inguinal hernia. Weak musculature. Cecal prolapse.	Excellent
(7) H. S.	66	M	Left inguinal mass twenty years. Increasing in size.	Left inguinal hernia. Weak musculature. Prolapse of sigmoid colon.	Excellent

(2) A new operative technique is devised.

(3) Results to date are excellent.

(4) At least eight months have elapsed since the most recent case reported here.

CUTTING PRETHYROID MUSCLES FOR EXPOSURE IN THYROIDECTOMY

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IT is generally conceded that in thyroid surgery adequate exposure of the operative field is of primary importance. Full view of the lateral and posterolateral surface of the thyroid permits the operator actually to see the parathyroids in a majority of the cases, and to note the course of the recurrent laryngeal nerve, and, to visualize the trachea. With these structures in view their injury is readily avoided. Such exposure, in my experience, is best obtained by cutting the prethyroid muscles.

For various reasons cutting the prethyroid muscles is not generally practiced. It is felt that this unnecessarily injures these important muscles and may result in a deformity in the neck, and that good exposure can be obtained by retracting these muscles to one side. Increased operating time and an additional chance of postoperative collections of serum in the wound are also stated as reasons against cutting these muscles.

Cutting the prethyroid muscles, especially by the technique here described, gives no deformity in the end result. From an experience with several thousand operations on the thyroid, I am satisfied that normal function returns to these muscles after they are cut and atrophy does not occur when their main nerve supply is preserved. It is a common experience at secondary thyroid operations to find little evidence of the previous procedure, except a linear scar in the muscles. Repeated examinations of patients months and years after operation show no deformity or loss of adequate function.

The deeper of the two prethyroid muscles is the sternothyroid. This muscle is inserted into the oblique line of the thyroid cartilage and overlies, and is often adherent to, the superior pole and upper lateral surface of the thyroid gland. Adequate exposure of this superior portion of the thyroid gland is practically impossible in many cases by retraction of this muscle alone. The pole lies in such close association to the insertion of the muscle that the muscle must be torn from this insertion if the pole is visualized. Large pieces of

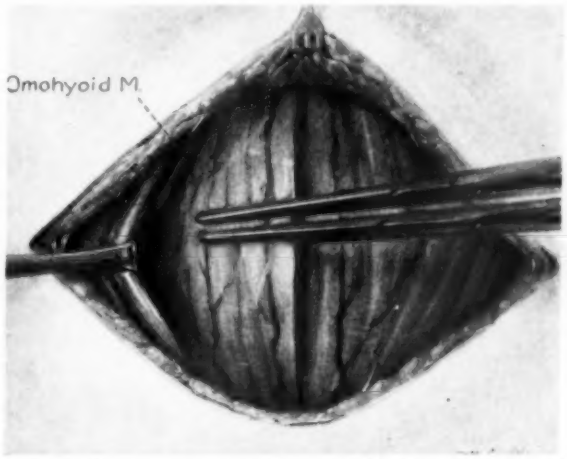

FIG. 1. The sternomastoid muscle has been retracted. Ochsner clamps are placed on the prethyroid muscles about an inch below the oblique line of the thyroid cartilage. Care is taken not to extend the clamps so far laterally that the ansa hypoglossi nerve or the omohyoid muscle is cut.

thyroid tissue may be left if full vision of the pole is not available.

The nerve supply of the sternothyroid, sternohyoid and omohyoid muscles enters through fibres of the ansa hypoglossi. This nerve enters the muscles at their lower extremities after making a long loop down the neck. Its course is readily visible when the sternomastoid muscle is retracted, lying in the lateral surfaces of the prethyroid muscles. (Fig. 2.) Care must be used to avoid cutting the main trunk of the hypoglossal loop when the prethyroid muscles are clamped and cut, by not extending the clamps too far in the lateral direction. (Fig. 1.) If the main branches of this nerve are thus preserved, muscle tone in the prethyroid muscles will not be lost, and postoperative atrophy will not occur.

Operators differ as to the level at which these prethyroid muscles should be clamped and cut. Some believe that the clamps should be placed on the muscles as high as possible to avoid all the nerve branches possible which enter the lower ends of the muscles. Clamping the muscles high, how-

ever, results in having only a short frayed end of the deep muscle remaining on the oblique line of the thyroid cartilage. This prohibits proper suture of this muscle after the operation. The clamps can be safely placed an inch below the insertion of the sternothyroid muscles on the thyroid cartilage. This leaves enough of the sternothyroid to be lifted cleanly from the surface of the upper thyroid pole without tearing it from the thyroid cartilage. Furthermore, this longer piece of muscle is more satisfactory for holding mattress sutures when the wound is closed than a short frayed end.

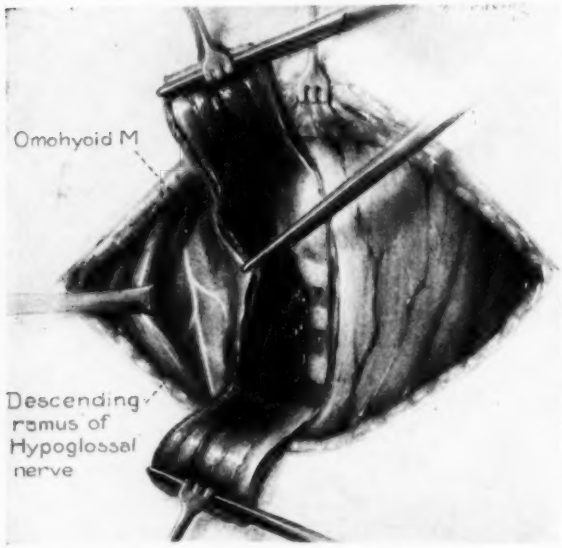

Fig. 2. Ready for closure after hemithyroidectomy. Note the uncut lateral portion of the sternohyoid and sternothyroid muscles. Note the course of the ansa hypoglossi nerve which can usually be clearly seen and avoided.

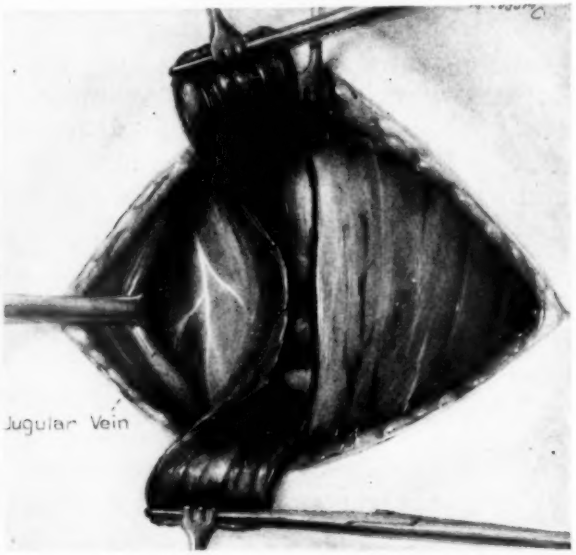

Fig. 3. Using the lateral areas of the prethyroid muscles to fill the cavity left by removing part of the thyroid gland.

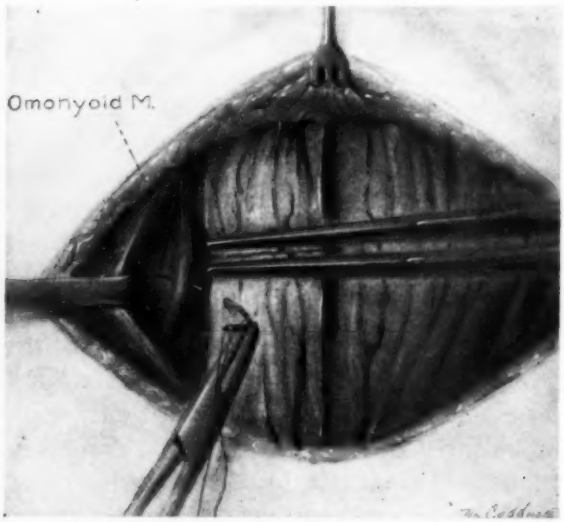

Fig. 4. Suturing the muscles at the end of the operation. The omohyoid is available to obliterate the lateral gap left by folding in some of the prethyroid muscles. Mattress sutures are placed to include any large veins on the surface of the muscles, and to give added strength to the closure.

The lateral uncut borders of the prethyroid muscles, furthermore, are very useful to pull in to the midline and to fold over the raw surface of the thyroid remnants. (Fig. 3.) This controls any bleeding and fills up the dead spaces left by the thyroidectomy. The belly of the omohyoid muscle is also preserved to fill the lateral gap left by the incision in the sternohyoid muscle, when the muscles are not cut so far laterally that it is divided. (Fig. 4.)

The slight additional time necessary to cut the prethyroid muscles and later to sew them, is well compensated by the increased ease and rapidity of completing the thyroidectomy under full vision of the gland. By using very fine chromic catgut for the mattress sutures in the prethyroid muscles and very fine plain catgut for bleeding vessels, postoperative drainage of serum is rarely troublesome.

CONCLUSION

Cutting the prethyroid muscles with careful preservation of their nerve supply gives adequate exposure in thyroid operations and produces no ill effects on the end results.

FUNCTIONS OF MEDIOTARSAL JOINT*

THEIR DISTURBANCE A CAUSE OF FLATFOOT

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THE mediotarsal joint is composed of two parts, the astragaloscaphoid and the calcaneocuboid, and divides the hindfoot from the forefoot. The chief motion is about a vertical axis and is in the direction of abduction and adduction. This vertical axis is not stationary; perpendiculars erected from tangents to the big toe, with the foot in various degrees of abduction and adduction, show it to be movable.

In extreme adduction there is an added movement in the direction of flexion at the mediotarsal and inversion at the subastragaloid. In extreme abduction there is an added movement in the direction of extension at the mediotarsal and eversion at the subastragaloid. There is also movement of the foot as a whole in the direction of adduction which takes place about a vertical axis through the joint of the astragalus with the internal malleolus. Flexion and extension at the mediotarsal takes place through a transverse axis. The latter is very limited and is accompanied by eversion. Movement in the direction of inversion and eversion occurs about a longitudinal axis passing through the subastragaloid joint. The movement is chiefly in the astragaloscaphoid and the subastragaloid joints.

If the forefoot is immobilized, as it is when bearing weight, and the ankle flexed by raising on tip toe, it will be seen that the heel is to the outer side of its normal perpendicular; that it is inverted through the longitudinal axis and that there is flexion and adduction at the mediotarsal joint. If this relationship between the forefoot and the hindfoot is preserved and the foot dorsal flexed at the ankle, the forefoot will show marked adduction; the foot will be toeing in. When toeing in, the foot is not in a normal position unless there is plantar flexion at the ankle and plantar flexion and adduction at the mediotarsal joint. Therefore a low heeled shoe should have a straight inner edge and a high heeled shoe should have the sole turned inward. If one rises on tiptoe while the toes are turned outward, there is little or no movement at the mediotarsal joint.

In flexion at the mediotarsal, with its accompanying adduction and inversion, the foot is shortened. That is why a high heeled shoe, which provides for extreme flexion at the mediotarsal, is shorter than a low heeled shoe. There are, however, high heeled shoes which do not provide for mediotarsal flexion, having flexion only at the ankle. These do not shorten the foot, the arch not being raised, and consequently force the wearer to toe out; to abduct, evert and extend at the mediotarsal joint.

Figure 1 shows diagrammatically the difficulty in attempting to walk with the toes pointing straight ahead without a functionating mediotarsal joint. The arc of movement through which the body weight must be raised is decreased by flexion at the mediotarsal.

If dorsal flexion at the ankle is limited, so that movement of the tibia on the astragalus is halted before the heel is raised, one of two things happens: (1) If halted at 90°, callosities from undue pressure form under the head of each of the five metatarsals. This condition is pathognomonic of a shortened heel cord and is a prolific cause of the various forms of metartarsalgia. (2) If the limitation of

* Read at the Annual Meeting of the Academy of Orthopedic Surgeons, Jan. 1935, New York City.

dorsal flexion is greater than 90°, it is necessary to toe out, thus shortening the lever arm. Although the distance between the

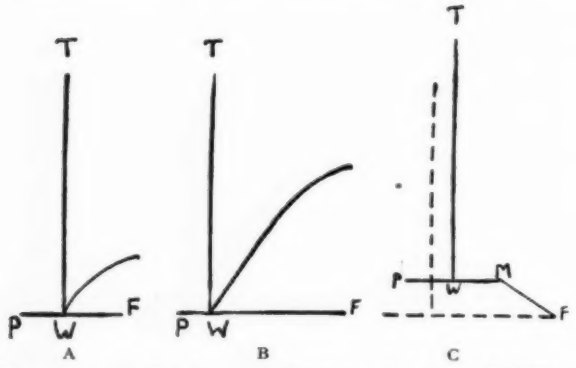

Fig. 1. T-W, tibia; P, attachment of tendon Achilles; F, metatarsal-phalangeal joints; M, mediotarsal joint. The foot-pounds of energy expended in raising W about F are decreased when the radius of curvature (W-F) is decreased by flexion at M. A and B illustrate the difference in the radius of curvature in a short foot and a long foot. In C the radius W-F is shortened by flexion at the mediotarsal.

fulcrum (the matatarsophalangeal joints) and the heel is the same or greater, by abduction at the mediotarsal and external rotation of the leg, this fulcrum is brought back nearer the transverse plane containing the center of gravity, thus shortening the lever arm, as movement is still directly ahead. (Fig. 2.)

The A-P plane containing the center of gravity should fall over the forefoot in which position it will be well supported. In abduction of the forefoot and external rotation at the hip the A-P plane of gravity is poorly supported and the superincumbent weight is a constant force acting to still further abduct, evert and extend the mediotarsal joint. This force is increased as the flat-foot walker pushes himself along with the inner side of the foot. This causes pressure of the foot against the lateral side of the shoe and results in callosities on the dorsal surfaces of the first interphalangeal joints of the two outer toes and on the lateral side of the fifth metatarsophalangeal joint. The greater part of the pressure which is normally distributed over the plantar surface of the forefoot is shifted, by eversion, to the region of the first metatarsophalangeal joint and is a cause not only of calluses under the joint but of deformities of the joint itself. The shoe will show wrinkles or folds, usually two or three,

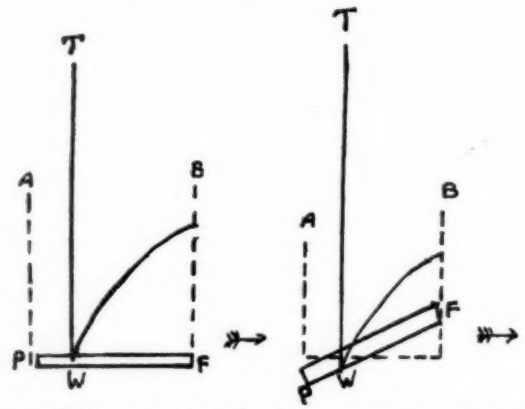

Fig. 2. When the foot (P-F) is turned outward, the vertical planes containing P and F (A-P and B-F) approach each other. With movement continuing in the same direction, the lever arms will be shortened and the fulcrum will be thrown off the line of motion. Thus the weight will be raised through a smaller arc.

in the leather mesial to the first metatarsal, from the strain in abduction and dorsal flexion. The sole of the shoe will show greater wear on the mesial side than on the lateral side. The back of the heel will show greater wear on the lateral side from striking the ground with the toes turned outward. The shank of the shoe, unless it is very stout or reinforced, will curve downward, pressed into this position by abduction and dorsal flexion at the mediotarsal joint.

Thus we see that for grace, precision, alertness and strength in the use of the foot a normal mediotarsal joint is necessary. The athlete and the dancer use this joint. It is for walking alone that we have adopted footwear which immobilizes the mediotarsal joint. Sometimes the joint is immobilized by the shoe in one of its normal positions but it can not fully functionate. As it matters little how the foot is clothed when not in use, we see many people with excellent feet who wear immobilizing shoes part of the time. This is because they wear proper footwear when exercising. When they play tennis or handball or run or dance they wear shoes which do not immobilize, and arch support-

ing shoes only when the feet are mostly inactive.

One of two things must be done to relieve the strain and pain arising from loss of function of the mediotarsal joint. Either the support which is lost by the abduction of the forefeet must be provided by extraneous methods (steel shanks or arch supporters) or the mediotarsal joint must be restored to its normal function. The provision of a shoe permitting normal movements at the mediotarsal will not of itself restore these movements. Many have expected such a shoe to cure their condition, only to find their feet much worse after its use. The foot must be prepared for the resumption of its normal functions; shortened muscles must be lengthened, weak muscles strengthened and joint and muscle sense educated. Adhesive plaster is an excellent educator. It should be applied not to immobilize but to restrain abduction at the mediotarsal and eversion of the heel.

As the first metatarsal is lowered at the mediotarsal in abduction and extension, a wedge reaching from the shoe to the ground under the first metatarsal, is an excellent aid. (Fig. 3.) Its lower surface is exactly in the horizontal plane upon which rest the sole and heel. Its presence will be felt by the wearer only when he attempts to abduct the forefoot. No wedge on the inner side of the sole is necessary. The inner side of the heel is wedged at the anterior corner, to tilt up the heel in flexion and inversion. This wedge may be $\frac{1}{8}$, $\frac{1}{6}$ or $\frac{1}{4}$ inch at its thickest part, depending upon the degree of eversion present.

The objection to high heels rests on their tendency to immobilize the mediotarsal joint, with the resultant loss of spring or elasticity of step, and the necessity of walking on the heels which, with each step causes a shock to the nervous system, not to speak of the wasted muscular efforts.

These nervous shocks may be very slight and yet, from their repetition at each step, may have a far reaching effect. This point is illustrated by the man with a severe

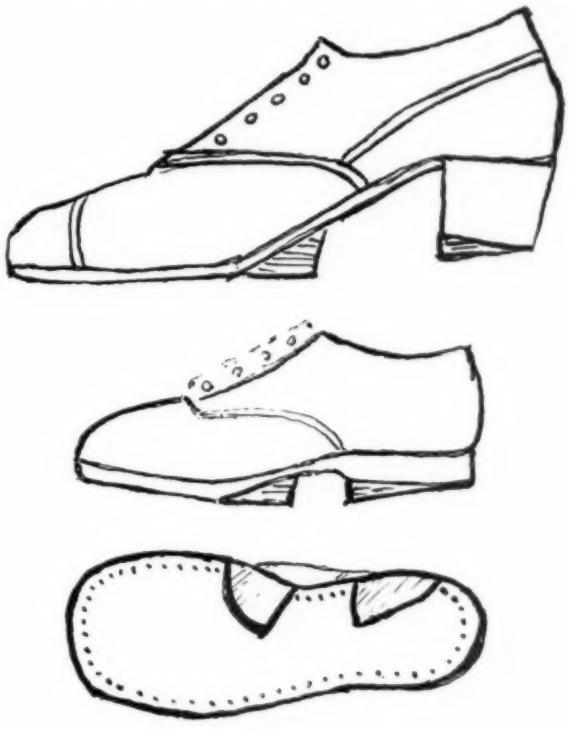

Fig. 3.

headache who unconsciously protects his nervous system from this series of shocks by walking, or teetering along, on his toes.

SUMMARY

Loss of the normal function of the mediotarsal joint is, I believe, the most frequent cause of foot complaints. This loss of function is due in great part to the use of footwear which obstructs the normal range of motions at the mediotarsal joint.

Restoration of full use of the mediotarsal joint must be accompanied by lengthening of muscles when shortened, strengthening when weakened and re-education when vicious habits have been formed. The traction shoe, adhesive plaster and an original metatarsal shoe wedge are suggested as useful methods to this end.

SUBSTERNAL THYROID*

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IN spite of the voluminous literature which has accumulated relative to the thyroid gland, only a small portion is devoted to substernal goiters and limited in the main to reports of a few large series and isolated case histories.

It is purposed to present an analysis of 212 cases of substernal goiter which were operated in the Guthrie Clinic from 1910 to 1934. This group of substernal goiters includes all thyroid glands the lower border of which on swallowing, remained definitely below the suprasternal notch. The dividing line between substernal and intrathoracic is so difficult to establish in reviewing old histories that the latter term will not be used. Suffice to say that 8 of the 212 cases, or 4 per cent, rested upon or reached below the aortic arch.

HISTORY

Curtis[1] in a survey of the early literature found Albrecht von Haller, an anatomist at Goettingen, to have observed an intrathoracic goiter in a cadaver in 1749, while in 1826 Dubourg reported a clinical case of strangulation found at autopsy to be the result of similar pathology. Curtis[1] also noted Adelman to have recognized a malignant intrathoracic goiter in 1828 and in 1851, Bonnet to have described compression and deviation of the trachea resulting from pressure. Wuhrmann in 1896 is credited[1,2] with reporting 91 cases and summarizing the literature.

Following the advent of the roentgen ray in 1895 the accurate diagnosis of intrathoracic extensions of the thyroid gland was made possible.

ANATOMICAL CONSIDERATIONS

The thyroid gland according to Morris[3] is surrounded by a connective tissue sheath derived from the deep cervical fascia. The latter, arising from the lateral vertebral processes, gives off a layer, the transverse aponeurosis of the neck, which passing medially separates into two layers to form the carotid sheath. Medial to the sheath these layers do not unite, the posterior one passing behind the pharynx while the anterior pretracheal layer divides to enclose the thyroid to which it is loosely attached. The gland is suspended in this sheath by three or four ligaments from the laryngeal and tracheal cartilages.

The middle cervical fascia encloses the strap muscles and in common with them is attached to the manubrium and clavicles. The space between the deep and middle cervical fascias thus allows easy access into the mediastinum.

Behind the thyroid lobes lie the common carotid arteries, the left descending beside the trachea to the aortic arch; the right descending to its origin from the innominate artery. Lateral to these arteries though in the same sheath, along the lateral border of the thyroid lobes, lie the internal jugular veins. The left unites behind the clavicle with the left subclavian to form the left innominate which in turn passes behind the manubrium to join the short right innominate thus forming the superior vena cava.

The vagus nerve descending in the carotid sheath, and the phrenic lying upon the anterior scalenus muscle, pass into the thorax anterior to the arterial

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trunks but posterior to the venous. The vagus is more medial and gives off the recurrent laryngeal nerves.

The thoracic duct passes anteriorly over the dome of the left lung to join the left subclavian vein. The accessory hemiazygos vein unites through the superior intercostal vein with the left innominate while the azygos vein enters the superior vena cava. The symptoms of substernal thyroid result largely from pressure upon these structures.

ETIOLOGICAL FACTORS

Lahey[4] states that in 4363 exophthalmic goiters not one was substernal, while in 5131 adenomatous goiters 21 per cent extended into the mediastinum. Occasionally diffuse colloid goiters may be partly substernal later becoming nodular. A nodule in one of the lower poles is elevated innumerable times by swallowing against the resistance of the strap muscles, collars, and gravity, hence a tendency toward lengthening its supports and a descent of the nodule. It slips into the mediastinum, between the middle and deep cervical fascia. Once past the superior thoracic aperture the enlarging thorax allows easy progress while enlargement of the adenoma through hemorrhage may prevent its return into the neck.

The connection with the parent gland may become merely a fibrous cord thus forming the false aberrant thyroid lobe. Lahey[4] does not believe excessive descent of the thyroid in fetal life is a factor. Felberbaum and Finesilver[5] suggest that the descent of the thymus or heart in the fetus may draw thyroid tissue into the thorax.

Pemberton[6] believes that most so called aberrant substernal thyroids have some connection with the parent gland. However, thyroid tissue has been found in the larynx, trachea, bones, pleura, pericardium, and ovaries according to Lazarus and Rosenthal[7] and is probably responsible for an occasional rare case of substernal goiter. Terry[8] states that in the Pathological Institute of Berne there is a congenital goiter filling most of the thorax.

In one case of this series the connection above the substernal mass was so slender it was nearly overlooked. In a second case a small adenomatous mass lay posterior to the right carotid sheath behind the transverse aponeurosis in the posterior mediastinum, and was regarded to be possible aberrant origin. Pemberton[6] reported a similar retrofascial mass with a pedicle, however, attached to the isthmus, and suggested that a small nodule may have penetrated a vascular channel in the fascia.

Lahey[4] reports an average age of fifty in 1086 cases, Pemberton[9] forty-six, and Curtis[1] forty-nine years. The youngest was eighteen years of age and the oldest seventy-two, 36 per cent being in the fourth decade. The average age in the group at this Clinic has slowly risen from a five year average of forty-two years preceding 1916 to fifty-three prior to 1935, the average for the 212 cases being 46.8 years.

The incidence of substernal goiter at this clinic was .33 per cent of all surgical admissions and 6 per cent of thyroidectomies, .3 per cent of these reaching the aorta or below. These figures are low, Jackson[10] in 4006 thyroidectomies at the Mayo clinic reporting 13.5 per cent substernal and .6 per cent intrathoracic. Higgins[11] found 10 per cent substernal and 1 to 2 per cent intrathoracic and quotes Czermak's figures of 32 per cent substernal in 1473 cases.

The sex distribution here was 89 per cent females comparable to that of adenomatous goiter in general.

SYMPTOMS

The symptoms may be interpreted in the light of toxicity and pressure. Since 1920, 70 per cent in our series have been toxic, the average basal metabolic rate being plus 29 per cent and also showing a gradual rise, the average since 1930 being

plus 33 per cent. The normal range of plus 10 to minus 10 was maintained by 26.5 per cent while 3.5 per cent averaged minus 20 per cent. These figures are the reverse of Lahey's[4] who reports 70 per cent nontoxic, as does Jackson.[10] Higgins,[11] however, reports nervousness and tachycardia in over 50 per cent, the average basal metabolic rate being plus 32. The toxic symptoms in our series in the majority of cases were associated with pressure symptoms, the two being of comparative recent origin.

Since 1920, 97 patients with a history of goiter for an average time of seventeen years were treated, only 2 having no obvious enlargement. Among the 212 were 8 recurrences operated nine to twenty years ago, all returning with symptoms of pressure and toxicity, giving roentgen ray evidence of substernal thyroid.

Pressure symptoms were also present in 70 per cent, the commonest being that of tracheal compression and irritation, namely dyspnea on exertion, a "hacking" cough, and choking. Lahey[4] has well described the choking attacks occurring at night caused by plugs of mucus below the tracheal constriction and relieved by coughing out the offending substance; also the inability of the patient to lie on the side which stretches the trachea over the mass.

Choking occurs generally on bending forward or at times on raising the arms above the head and poor posture was assumed by a number of our patients as a defense mechanism against this distressing symptom. The head is held partly bent forward, this being the position of least traction on the substernal adenoma and least pressure on the adenomatous tissue above it. The plunging adenoma, or one which is movable in the mediastinum and appears in the neck at intervals, was not seen. Such goiters cause severe intermittent attacks of choking which may terminate fatally.

Dysphagia is not common but is more frequent in left sided goiters, attributed by Lamson[12] to the fact that the esophagus curves to the left. Pulsion diverticula of the esophagus may be augmented by the pressure of a substernal goiter as in the cases of Bouvier and Haberer quoted by Curtis.[1]

Pressure on the recurrent nerve leads to the symptom of inspiratory stridor apparent perhaps only on deep inspiration. Dyspnea on exertion is often present but the speaking voice is usually unimpaired. Hubert[13] reported a case of substernal goiter with fixation of the left cord in the midline and partial abductor paralysis of the right with stridor and dyspnea but only slight hoarseness. Such bilateral paralysis from goiter is rare unless malignancy is present. Hoarseness is more often the result of irritation of the larynx and trachea than to nerve injury. In this series 11 per cent suffered from hoarseness of whom only 46 per cent had cord changes.

Pressure on the innominate veins may cause dilatation of the cerebral veins which, according to Pilcher and Overholt,[14] results in vertigo, headache, lethargy, fullness in the ears, and dryness and edema of the skin. The venous pressure may be elevated in one arm or both, with relief of all symptoms following thyroidectomy. Insufficient filling of the heart provides an extra burden to the myocardium. Cyanosis of the head and shoulders may appear on bending forward, and from long standing pressure the veins about the base of the neck and upper thorax become dilated and tortuous, first as varicosities and later as collateral circulation. Schwyzer[15] described a case of hydrothorax resulting from pressure on the azygos system.

Very unusual is the case of Schultze quoted by Curtis[1] in which pressure upon the thoracic duct led to a chylothorax.

Unilateral phrenic paralysis with elevation of half the diaphragm was noted by Bachford,[16] and shifting of the heart with decompensation. Higgins[11] lists 2 cases of unequal pupils from pressure on the sympathetic system, while involvement of the vagus may lead to tachycardia.

It is thus seen that the symptoms may be analyzed from the standpoint of the structures involved. An astonishing fact is the size of the tumor to which the mediastinum can accommodate itself without severe pressure symptoms.

DIAGNOSIS

In the presence of any of the foregoing symptoms of pressure, in the fourth or fifth decade of life in whom a nodular thyroid gland is present the lower limits of which the finger can not outline, substernal goiter must be proved absent.

There is usually a long history of goiter with a recent onset of coughing or choking attacks at night, hoarseness and dyspnea on exertion. Toxic symptoms may be present.

On examination a nodular thyroid extending below the sternum may be found which moves but little on swallowing, often associated with deviation or torsion of the trachea and dilated veins over the upper thorax. In the absence of a cervical goiter on swallowing one may feel the rise of a substernal mass in the suprasternal notch. Few believe percussion is of value but it may give suggestive dullness.

Rankin[17] lists four signs of carcinoma all of which were present in the one case in this series: (1) Goiter present many years; (2) Recent increase in size; (3) Hoarseness, cough, dyspnea, cyanosis; (4) Paralysis of one or both cords. He also quotes Pemberton's figure of 2.7 per cent carcinomas in colloid and adenomatous goiters, the majority unsuspected, and Boarings 1.53 per cent in 11,100 supposedly benign adenomas. There was .43 per cent in this series.

Asthma and chronic emphysema may be simulated very closely, and if without a palpable goiter or toxic symptoms, the roentgen ray may reveal the offending tumor in the thorax. Angina pectoris may at times be confusing but the electrocardiogram and the roentgenogram should insure the proper diagnosis.

Although the roentgenogram is of the greatest value, large substernal extensions may be overlooked. Higgins[11] advises anterioposterior and oblique views with stereoscopic and fluoroscopic study of all mediastinal masses. While an aortic aneurysm is characterized by a positive Wassermann, expansile pulsation, and a constant angle with the aorta on breathing and swallowing, a substernal thyroid will change its angle with the aorta (Maclean[2]). The former is more common in men and the latter in women.

The thymus rarely causes pressure symptoms in adults and its roentgenologic outline is more hazy.

Dermoid cysts may give extensive pressure symptoms, eventually ulcerating into a bronchus with the expectoration of hair (Maclean[2]). They are not elevated by swallowing and have no connection with the cervical region. Fluoroscopically they are dense and smooth and symptoms frequently appear soon after puberty (Wessler-Jaches[18]).

Diverticula of the esophagus may be differentiated by the relation of symptoms to meals and the swallowing of barium.

Hodgkin's disease, tuberculosis and the leukemias are characterized by fixed glandular masses about the hilus of the lung and frequently external glands are available for biopsy. Blood studies are important.

PATHOLOGY

Approximately 90 per cent of the removed thyroid tissue in this series was diagnosed as colloid adenoma, usually multiple, with cystic changes in 15 per cent, calcification in 12 per cent, and hemorrhage in 10 per cent. Hyperplasia was reported in 2 cases or about 1 per cent, the remaining 9 per cent being diffuse colloid goiters. Higgins reports 3 cases with hyperplasia but Lahey[4] has never seen a case of true exophthalmic goiter develop substernally.

Carcinoma was present in one case of our series or .43 per cent.

The substernal mass was on the left side in 76 cases, on the right in 40, bilateral in 32 and reported merely as substernal in 36 cases. In 2 cases large cysts were adherent to the aorta, one of which contained pus like material within friable walls. Curtis[1] states arteriosclerosis and hyaline changes in the vessels are common, resulting in hemorrhage and cyst formation, and with Delaney[19] has reported a case of cavernous hemangiectasia within a nodular goiter.

TREATMENT

Irradiation therapy for thyrotoxicosis is shown in a favorable light by Pfahler,[20] Davies,[21] and Stevens,[22] but the substernal adenomatous mass causing pressure and at times toxic symptoms, prone to hemorrhage, calcification, and cyst formation, is generally considered a surgical problem.

The preoperative care of thyroid patients in the Guthrie clinic has been reported in detail by Guthrie and Conklin.[23] A modified anoci-association technique is used, the patient believing he is to have a basal metabolic rate taken. Sodium amytal in doses of 6 to 9 gr. is given two hours before operation. At times a basal dose of avertin is given thirty minutes preoperatively instead of the sodium amytal. Morphine gr. $\frac{1}{6}$ and atropin gr. $\frac{1}{100}$ are included and ethylene given as needed.

Lahey[4] and Young[24] strongly advise an intratracheal catheter in substernal cases to insure a free air passage. Colp[25] reported a case with severe pressure symptoms which he safely removed with a 17 mm. bronchoscope in the trachea.

The superior polar attack is employed in this clinic, the branches of the superior thyroid artery being clamped and cut individually as they run over the upper pole, carefully excluding the muscle tissue. The upper pole is easily rolled down and the lobe separated from the trachea leaving a strip of gland over the recurrent laryngeal nerve and the parathyroid bodies. Over the upper tracheal rings where the gland is most adherent the nerve may lie within the substance of the lobe, hence the need of leaving a thin layer of thyroid tissue. Guthrie[26] has emphasized the importance of wide exposure and the removal of all hemostats before attempting to elevate the substernal portion, and has described[27] an everchanging attack upon the gland compatible with quiet respiration which avoids traction injury to the nerves. Any adventitious sound may be charged to operative trauma and not to the ethylene anesthetic.

The finger is passed into the mediastinum between the lobe and the carotid sheath and the mass explored and gently freed from its capsule. The finger is then removed and using the lobe as a tractor, an attempt is made to elevate the substernal portion the anesthetist being prepared to furnish oxygen under pressure if tracheal embarrassment arises.

In some cases the finger or a silver spoon (Lamson[12]) must be used below the gland. In one case of this series it was necessary to aspirate a cyst prior to its removal while in a second the friable walls of a cyst were so adherent to the aorta that a portion was allowed to remain. Care must be exercised to avoid overlooking a second projection, as in 8 cases one lobe occupied a portion of the anterior mediastinum and the opposite lobe the posterior. Morcellation may be necessary at times but is undesirable. Notching or splitting of the sternum was not required in any case.

After delivery of the mass the vessels at the lower pole are clamped and cut as they branch up on the gland thus protecting the nerve where it lies in close association with the inferior artery. Further protection to the nerve is obtained by clamping and tying the inferior thyroid vessels in the long axis of the neck. The internal jugular vein was injured in 2 cases as it may be elevated far above its normal position through elevation of the lobe; no ill effects followed isolation, section, and ligation of the vein in either case.

Lahey[4] packs the cavity for one week as a precaution against mediastinitis, the packs then being replaced by rubber tissue. In this clinic rubber tubes are placed in the cavity to be removed in three to five days, after which rapid obliteration of the cavity occurs through the lung resuming its original domain. Maclean[2] ligates the bleeding points in the cavity and stitches the ligatures into the sternocleidomastoid muscle thus elevating the floor of the space.

In this series no mediastinitis, rupture of the pleura or herniation developed. Shifting of the deviated trachea toward its normal position was observed but tracheal collapse was not encountered.

Postoperatively, avertin insures the patient a quiet period when restlessness and coughing greatly increase the danger of secondary hemorrhage. Laryngeal examinations should be made at intervals. Roentgenograms will show gradual obliteration of the old tumor cavity and the return of the trachea to the midline. Cattell[28] found the trachea to return to the midline within three months and to regain its normal size and shape. The so called tracheal collapse he believes is due to hemorrhage or nerve injury.

COMPLICATIONS AND MORTALITY

Among the 212 cases were 6 deaths, a mortality of 2.8 per cent as compared with 1.1 per cent for all thyroidectomies in the past ten years. Lahey[4] reports a mortality of 2 per cent but only 30 per cent of his cases were toxic. The 6 cases ending fatally were all large substernal goiters, all mildly toxic, with an average age of fifty years.

Deaths	Time	Cause of Death
1	6 hours	Cardiac dilatation
1	20 hours	Myocardial failure
1	20 hours	Myocardial failure
1	8 hours	? Cyanosis dyspnea Tracheotomy failed
1	15 days	Multiple hemorrhages
1	4 days	Pneumonia

Three deaths were the result of cardiac collapse. Severe myocardial damage was present in all three patients but the severity of the symptoms demanded surgical relief. It is difficult to estimate the burden thrown upon the heart by the removal of an intrathoracic mass.

Massive hemorrhage is a serious complication not so much from loss of blood as from the possibility of suffocation, the shock of opening the wound, and the danger of injury to the parathyroid bodies. The first interne to attend such a patient should be authorized to open the incision at once. In the operative technique, the vessels must be caught accurately before dividing, thus preventing their retraction, and when tied firmly with silk they may be considered secure. Mass ligatures must be avoided and the muscle excluded.

One of the reported fatalities was the result of repeated hemorrhages in a sloughing bed. A second case was returned to the operating room and the bleeding vessel secured with recovery.

Tracheotomy was performed on the one patient in the presence of cyanosis and dyspnea without success. A saber trachea was present before operation, the result of bilateral substernal adenomas with paralysis of the left cord. No hemorrhage was present. It must be remembered in cases of low tracheal obstruction an unusually long tracheotomy tube is required.

Following operation the patient is placed in a semireclining position, drafts are avoided, steam or compound tincture of benzoin inhalations given as required, and sips of warm soda water provided. Carbon dioxide inhalations are carried out at the first sign of atelectasis. In spite of these measures one death resulted from pneumonia.

In most cases the larynx was examined before and after operation. No case of

preoperative cord paralysis was improved but several cases with marked lagging became negative following surgery.

Following operation the left cord was involved twice as often as the right, explained perhaps by the higher incidence of the tumor on the left. Lagging of the cords was symptomless and transient. Unilateral fixation in the midposition was accompanied with only slight inspiratory stridor in a few instances and with no change in the speaking voice. A number recovered later. Two cases of bilateral fixation in the midline were not severely handicapped, one breathing and talking easily but snoring when asleep.

Paralysis following thyroidectomy may consist in fixation of the cord in the midline, i.e., paralysis of the abductors with preservation of adduction. The function of abduction in the recurrent laryngeal nerve is much less resistant to injury than that of adduction, and it is possible that many such palsies are the result of stretching or pressure on the nerve. Lemere[29] states that even after complete section of the recurrent nerve the cricothyroid muscle enervated by the external ramus of the superior laryngeal nerve still tenses and slightly adducts the cord. Freedman[30] reports 7 such abductor palsies with normal speaking voices.

Section of the external ramus of the superior laryngeal nerve relaxes the cord causing slight difficulty with phonation but no dyspnea. Section of both nerves on one side results in a cadaveric position rarely seen in thyroid surgery.

Bilateral recurrent nerve injury brings the cords together in the midline with inability to abduct hence inspiratory stridor is often severe but at times with a good speaking voice.

Tetany was not encountered. Ligation of the three branches of the superior thyroid artery on the surface of the gland preserves any separate branches to the parathyroid bodies. Dramatic results may be obtained with parathormone and calcium in the acute case of tetany and the high calcium low phosphorus diet has been used in this clinic with marked success in the chronic type.

CONCLUSIONS

The recognition and safe treatment of substernal goiters has been largely evolved since the discovery of the roentgen ray. Substernal goiters develop in most cases from adenomatous thyroid tissue. This development may be explained on a mechanical basis.

The adenomas may project into the anterior or posterior mediastinum or both, and are at times behind the transverse aponeurosis.

It is a disease of long standing, middle age, largely confined to females, and is not uncommon where goiter is endemic. Toxicity is present in from 30 to 70 per cent of cases.

The treatment is surgical removal; all nodular goiters which extend below the sternum should be explored, regardless of symptoms.

An operative technique is described which safeguards the nerves from direct injury and from traction, protects the parathyroids and their blood supply, and makes possible the delivery of the substernal mass.

Early removal of the drainage tubes allow a collapse of the cavity without danger to the mediastinum.

An analysis of the causes of death following surgery clearly indicates the need for earlier treatment.

Tetany may almost be eliminated with careful technique.

Lagging of the cords before operation may disappear after thyroidectomy.

Laryngeal involvement postoperatively in most cases is the result of traction or pressure from tissue swelling and the majority will recover.

Permanent abductor paralysis of one cord is not attended usually with serious difficulties.

[For Remainder of References see p. 99.]

EVISCERATION AND AVULSION OF ABDOMINAL WOUNDS*

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ONLY in recent literature is any comprehensive reference made to the subject of evisceration, the discussions coming under the synonymous headings of eventration, evisceration, dehiscence, avulsion and rupture of abdominal wounds. Many theories have been advanced concerning the evolution of this condition, but the etiology of evisceration is not as mysterious as many would have us believe. The solution of any problem is extremely difficult or improbable when information pertaining to the evolution of the pathogenic processes is not available. Eventration has never been experimentally reproduced nor has anyone traced the developmental stages of this complication. However, we have arrived at the conviction that evisceration is primarily the end result of increased intra-abdominal pressure, while the great number of other factors generally enumerated are secondary.

During the past ten years the combined surgical staffs of the Metropolitan Hospital have performed 3234 laparotomies. Of this number, only 8 cases, or 0.24 per cent, of eventration were present with a mortality of 75 per cent. Similar methods of abdominal closure were employed throughout, that is, closure by layers with plain catgut for the peritoneum, chromic catgut for the fascia and non-absorbable suture for the skin. For the past few years Dr. Fobes and his staff have reenforced the fascial layers with ox fascia in those cases where a weak abdominal wall or other similar conditions suggested its prophylactic use.

DEFINITION

Evisceration, eventration, prolapse of intestines, dehiscence, rupture, disruption, avulsion, separation of abdominal wounds, all these concern the giving way of the incision. The first three terms include the protrusion of viscera or disembowelment, the others refer to a splitting or breaking of the wound. This terminology is often misconstrued and must not be considered synonymous. With this in mind we have included expressions of both conditions in the title of this paper.

ETIOLOGY

Our personal experience and a review of the literature would lead us to the conclusion that the accident of evisceration or avulsion of abdominal wounds is primarily due to increased intra-abdominal pressure. Except from the viewpoint of prophylaxis, all other factors such as careless technic in suturing, systemic disease, infection, etc., play only a secondary role in the causation of the accident. For completeness, we will first discuss the secondary factors preliminary to the exposition of our contention that increased intra-abdominal pressure is of greatest etiological importance.

Age: At first glance, age would appear significant because the incidence of disruption is statistically greater between the third and fifth decades. However the accident has been noted in every period of life and since the greater number of operations occur between thirty to fifty years, interpretation of figures is misleading.

* From the service of Dr. J. H. Fobes, Director of Surgery, Metropolitan Hospital, New York City.

Sex: Sokolov,[26] Meleney and Howes,[6] and others have placed the incidence of occurrences in the ratio of two males to one female. The majority of writers however agree that there is no sex relationship. In our small series of 8 cases, there were six males and two females, a ratio of three to one.

Season: Seasonal relationship is mentioned only by Sokolov,[26] who contends that the avulsions are present chiefly in the winter and spring seasons. This data was derived from cases occurring in the locality of northern Europe. He attributes this to the lack of fresh vegetables in the diet during these seasons, resulting in a condition similar to scurvy, interfering with tissue healing.

Infection and Drainage: There is much controversy concerning the relationship of infection and drainage to dehiscence. Infection causes an early absorption of catgut and is also responsible for the slipping of knots. However the percentage of wound disruptions in infected cases is not sufficiently high to warrant placing it as a prominent etiological factor. In Colp's[5] series, the incidence of dehiscence in drained cases was 1.22 per cent as compared with 0.84 per cent in undrained cases. Drainage is best obtained through a stab wound removed far from the incision, thereby diverting the drainage tract from a field which may heal by primary union with less likelihood of postoperative hernia formation. In Cave's[7] series of 444 cases he noted that in 282 operations without drainage there were no postoperative hernias, while in 162 drained cases, 21, or 12.9 per cent, hernias were present.

Type of Operation: Eventration has occurred most frequently following operations for gall bladder and gastric disease, malignancy and uterine fibroids. It should be kept in mind that these cases are commonly followed by complications such as emesis, distention, pneumonia, etc. The significance of this will be discussed later. The operations mentioned are those in which there is more than the ordinary amount of trauma and manipulation. The time factor has not been regarded as being important etiologically. However, trauma to the viscera or a shocking procedure must be considered.

Systemic Disease: It has become an accepted dictum that wounds heal slowly in the presence of systemic disease, such as syphilis, diabetes, jaundice, cancer, in the aged and the debilitated. However, it is also a fact that when dehiscence does occur following the primary operation, even in the presence of systemic disease the wound heals remarkably well when resutured. Why? There have been many instances of normal healing in syphilitics. It is not our purpose to dispute the fact that systemic disease may and does affect healing, but we feel that its relationship to dehiscence is not direct or of major significance.

Day of Disruption: Disruption commonly follows the removal of the sutures on the seventh or eighth day. The following table illustrates the experience of several surgeons.

Meleney and Howes[6]	seventh to tenth day,
White[8]	eighth to tenth day,
Colp[5]	second to eleventh day (seventh most common),
Lahey[9]	seventh to twelfth day,
Starr and Nason[13]	usually eighth day.

In our series of 8 cases, evisceration occurred on the fifth, sixth, eight (3 cases), ninth, eleventh and twelfth postoperative day.

Commonest Site of Disruption:

Madelung[25]	Lower abdomen,
White[8]	Upper abdomen,
Grace[4]	Upper abdomen; 39 of 46 cases,
Horsley	65 per cent above the umbilicus in 21 cases,
Freeman[11]	Lower abdomen,
McCauliff[12]	Nearly 100 per cent above the umbillicus.
Starr and Nason[13]	Majority in lower abdomen.

The upper abdomen is the most common site of disruption. In our series, 7 were upper abdominal.

Incidence:

	No. Laparotomies	Per Cent
Colp[5]	2750	0.9
Holterman of the Marburg Frauen-Klinik	786	2
Fincke of the Marburg Frauenklinik	....	1.1
Chicago Lying-in Hospital—1010 cesarean sections	....	0.3
McCauliff[12]	....	0.1
Starr and Nason[13]	2455	0.61
Kennedy[15]—Joseph Price Hospital No evisceration in 56 years	....	
Sokolov[26]	....	2 to 3
Metropolitan Hospital, New York City	3234	0.24

Type of Incision: Undoubtedly the type of incision is important in the etiology of disruptions. In considering this relationship a few anatomical facts are brought to mind. The fibers of the posterior sheath of the rectus run transversely. Many believe that this layer is the first to break under the stress of disruptive forces. In great part, the elastic fibers of the skin also run in the transverse direction and thus thin scars are seen in transverse wounds. The linea alba has a deficient blood supply and is therefore less resistant under stress. Respiratory movements exert a pull on the muscles attached to the costal angle and cause the greatest tension on vertical wounds. Disruption is by far commonest in vertical incisions. Meleney and Howes aptly state that "the position that the patient assumes or may assume after operation favors the closure of a transverse wound and favors the opening of a vertical wound. The Fowler's position in a Gatch bed relieves all tension on the wound surfaces of a transverse incision." Several investigators have commented on the etiological significance of the muscle splitting as compared to the muscle retraction operation, and the concensus of opinion favors the use of the latter method. However, opinions vary on this point. White[8] observed 30 instances of dehiscence following midline, split rectus and retracted rectus incisions but none after intermuscular, Pfannenstiel, costal or transverse incisions. Sokolov[26] collected 606 cases of disruption of which 76.4 per cent were in midline incisions. Of these, 229 cases or 57 per cent, were above the umbilicus and 167 cases or 42.18 per cent, were below. Madelung[25] had 140 midline cases with 124 disruptions below and 16 above the umbilicus. Since Madelung operated chiefly on gynecological cases, and those operated above the umbilicus were mainly poor operative risks such as in cancer and gastric resections, his findings are obviously not pertinent to the question under discussion. Colp's[5] statistics reveal an incidence of 2.2 per cent disruptions in upper right rectus incisions, 0.54 per cent in lower right rectus wounds and 1.5 per cent in paramedian hypogastric incisions. McCauliff[12] believes that incisions through the muscle are more susceptible to disruption because of injury to the nerve supply. In his questionnaire sent to numerous surgeons, he found that 75 per cent of cases occurred after midrectus incisions and 25 per cent in transrectus and midline incisions. Starr and Nason[13] noted that the muscle retracting procedure was better than the muscle splitting or midline incisions. Grace's[4] experience with the McBurney operation reveals a complete absence of disruption. This has also been Colp's[5] experience although he used this incision in only 49 cases. Sokolov,[26] who has collected the largest series of disruption cases, mentions only 2 following the McBurney incision. All of our cases of evisceration occurred following vertical incision. Another factor regarding the incision is reoperation through an old scar. Although many surgeons claim that this is not an advisable procedure, we would disagree in the condemnation of this method. Colp[5] found no disruptions following excision of the old scar.

Type of Closure: In discussing the methods of closure let us first collect our knowledge on the subject of healing in wounds and the role played by the various

suture materials. We will then discuss the relative values of the different methods of closure and the materials employed. Firor[29] states that, "The natural method for obliterating a cavity in a clean wound is by filling it with a blood clot, and in an infected one by the production of granulation tissue. A sterile blood clot quickly adheres to the adjacent tissues, contracts, and becomes organized by fibroblasts. A study of the factors aside from infection that retard the healing of wounds is important. Old age, malignancy, anemia, and diabetes are general conditions which have untoward affects upon the normal healing processes." Normally, the fibroblasts begin to proliferate and arrange the structure of the new scar tissue after forty-eight hours. We have all observed that some wounds heal quicker than others, the conditions at the start being apparently equal. Aside from hematomas, seratomas, etc., the cause for delayed healing in some cases is controversial and usually theoretical. It would be of great advantage if catgut could be standardized. Inasmuch as twenty-day or forty-day catgut is often absorbed in as quickly as four to five days, it is difficult to attribute faulty healing to sutures whose absorption and tensile strength at a given time is actually unknown. However, we do know that catgut is rapidly absorbed in a sterile exudate or pus. White[8] aptly summarized one aspect of the question by describing the situation as, "people whose tissues for an unknown reason quickly absorb catgut." It is known that healing is approximately four times as fast in serous and mucus membranes as in muscle tissue. The larger the strand of suture material, the slower the absorption, this being especially true of the knot. However the reaction with heavy suture is greater. Absorbability is apparently a part of a process of digestion and solution, in which formed tissue ferments penetrate the suture. In Meleney and Howe's[6] 63 cases of evisceration there was a complete absorption of catgut. A probable explanation of this finding is suggested in our theory which is discussed later. In their selection of suture material, some surgeons feel that catgut causes a greater reaction in the wound than silk. Cave,[7] Meleney and Howes[6] claim that silk is better than catgut for clean cases because it causes less exudation, decreases the chances for infection and does not lose its tensile strength. They forbid the use of silk in infected cases. Several operators employ interrupted sutures for fascia. It is agreed that the eversion technic is best for peritoneal closure. Fascia must be sutured to cleansed fascia without the interposition of muscle or adipose tissue. Most observers have found that silkworm gut cuts into tissues and favors stitch abscesses. This type of suture has not prevented disruptions. White[8] prefers dermol to silkworm gut because it is less brittle, has uniform tensile strength and is less irritating to the skin. Colp[5] has employed retentions in only 12 of 2750 laparotomies. He claims that retentions tend towards fat necrosis with liquefaction, deep stitch abscesses and local necrotic damage. However retentions probably do play a part in the security of the wound. Kennedy favors the sole use of through and through silkworm gut for closures. He completely avoids buried sutures of any kind. He emphasizes care in retraction, minimum traumatization of tissues and decreased exposures. His reasons for discrediting the suturing of wounds by layers are, that, "each buried suture is in a sense a ligature and is accompanied by molecular death from the crush of tissues and the suture remains for some days a foreign body. There is a great exudation incident to buried catgut and the edema from it is probably the most potent factor in tardy healing." He adds that the through and through suture does not cause molecular death and furthermore serves as a drain.

THEORIES

1. Lack of healing power: Colp[5] observed that, "The crux of the problem seemed to rest in the failure of regenerative

powers of the tissues to promote healing." This explanation is frequently offered. However it is agreed that the same wounds heal well when resutured.

2. Formation of hematomas or seratomas: This theory is suggested by Lahey.[9] Hematomas are possible factors in cases of transverse incisions where the severed ends of the recti muscles are separated and leave a well. A similar situation in the ordinary properly handled wound is unlikely.

3. Infected wounds: The fact remains that wounds left wide open often heal well. Infection is probably only a contributory factor in dehiscence.

4. Ineffectiveness of sutures: They either absorb too early, cut through, or break; but this is usually secondary to other causes, i.e. absorption of sutures in serum, improper closure, increased intra-abdominal tension, infection, etc.

5. Freeman's Theory: Freeman[11] believes the primary cause to be inadequate closure of the peritoneum whereby the omentum acts as a wedge forcing its way through the gap in the peritoneum. Healing in the wound is thereby made impossible. The omentum becomes strangulated, inflamed, enlarged, and acts as a part of an "expanding wedge." Then rupture results from a sudden strain as sneezing, coughing etc. Since the omentum is located chiefly in the center of the lower abdomen, Freeman claims that disruptions occur most frequently at this site. He states that he has always found a tongue of omentum in the ruptured wound. The accident occurs early postoperatively as is generally evidenced by such signs as tumefaction, leakage of sanguinous fluid and signs of intestinal obstruction. He concludes that secondary suture results in firm healing because there is no protusion of omentum. In his experiments on dogs, conducted by the Department of Pathology at the University of Colorado, laparotomies were performed in which a tongue of omentum was placed under the sutured fascia between the muscles. There was failure of healing in a number of the dogs. However, no evisceration occurred, although Freeman claims that with the necessary strain the accident would have happened.

6. Weber's physico-chemical theory: Weber[21] assumes that the underlying cause of rupture is an increase in the acidity of the tissues due to some form of systemic intoxication.

7. Phlebitis Theory: Ducuing[1] noticed the presence of phlebitis in 4 of 5 recent cases. He claims that phlebitis causes an edema of the abdominal wall and, that, "parietal-venous thromboses and disturbances of the sympathetic innervation, determining local disturbances of the tissular trophism opposing cicatrization and favoring the cutting through of the stitches and the opening of the knots."

8. Toxic Theory: Healing is absent or retarded and dissolution of catgut takes place in the presence of toxemia, acidosis etc. Nevertheless, healing by primary union is the rule in nearly all cases of toxemia. No difficulty is encountered on secondary suturing.

9. Interference with nerve supply: Any incision through muscle which destroys the nerve and blood supply results in a loss of the buffer action of that muscle. However true this may be, the greater percentage of split muscle operations do not disrupt.

We maintain that the underlying factor in the causation of dehiscence is increased intra-abdominal pressure.

10. *Increased intra-abdominal pressure:* Cough, hiccough, meteorism, emesis, sneezing, gagging, gastric lavage and undue postoperative activity are manifestations of increased intra-abdominal pressure. The greatest intra-abdominal pressure is definitely in the upper abdomen. Incisional hernias must be considered in the same light as dehiscence, the former being the incomplete stage of what must eventually have resulted in wound disruption. The causative factor is therefore the same in both complications. Abel's statistics from German clinics showed 8.9 per cent hernias following longitudonal incisions with heal-

ing per primam, and 31 per cent after healing per secundam. Furthermore it has been found that the great majority of incisional hernias develop early after operation, from which their presence is presumed within the first week after operation. The incidence of hernias is interesting. Stanton found 24 postoperative hernias or 4.8 per cent in 500 laparotomies, Masson at the Mayo Clinic in 5502 cases of hernias of all types noted 10.8 per cent of incisional hernias; Roosevelt Hospital 6.02 per cent of 1928 hernias and 2.2 per cent of 5366 laparotomies; Coley 1.5 per cent of 3000 hernias. We believe that these figures actually give the incidence of potential disruptions. In all probability the deep dehiscence must have occurred at an early postoperative stage within the first few days, with the true state of affairs concealed by a united skin. In our opinion there is no mystery connected with this tragedy. When case records do not reveal a history of increased intra-abdominal pressure, patient interrogation will usually disclose that the patient did not complain of a violent sneezing or coughing spell or that the intern failed to record some sign of increased intra-abdominal pressure which was present. This pressure may be marked. Every surgeon knows the great force which is required to hold back the viscera during an operation when retching or vomiting occurs with the patient only partially under the effect of the anesthetic. A rough estimation of this pressure would perhaps be fifty pounds. Horner[2] records a case of evisceration through a forced *split in the fascia about 0.5 cms. from the suture line, the sutures remaining intact.* This was preceded by a persistent cough which was the cause of the increase in intra-abdominal pressure of this great degree. In another case, Horner noted a second evisceration following violent coughing where secondary through and through sutures had been employed. Case 1 of our series eviscerated five feet of small intestine through a small drainage opening following a gastric lavage with marked gagging. The entire wound was firmly healed with the exception of the drainage opening. Since the omentum had been anchored to the stomach at the primary operation, none was present in the wound when evisceration occurred. Dehiscence is more common in upper abdominal wounds because the pressure is greater in this region of the abdomen. Disruption is usually noticed after the seventh day because at this time the skin sutures are removed thus permitting a visualization of the underlying pre-existing pathology. The high incidence of disruptions associated with systemic diseases, as malignancy, diabetes, etc., may be explained by the fact that the recuperative powers of these patients are below normal and therefore they tend to become distended or develop other postoperative complications which increase the intra-abdominal pressure. Meleney and Howes[6] reported 63 cases of disruption, 49 illustrating increased intra-abdominal pressure. It cannot be denied that other factors, as infection, poor closure, systemic disease, etc., are of importance, but these are secondary and facilitate disruption only in the presence of increased intra-abdominal pressure. We cannot overemphasize the importance of exact postoperative progress notes in this regard. In Case 1 there was no record in the progress notes which could account for the disruption. However after careful interrogation the patient admitted severe retching and cough when a gastric lavage was attempted. This was followed almost immediately by evisceration. Thus, helpful data is obtainable in great part only from the patient himself.

MORTALITY

The mortality is lowest when evisceration occurs before the fifty day. Early recognition of the accident is important for a better prognosis. General reports on mortality throughout the United States varies between 30 to 75 per cent. The causes of death are peritonitis, hemorrhage, acute gastric dilatation, postoperative pneumonia

and shock. The following mortality tabulation is significant.

McCauliff[12]	6 per cent in clean cases; 50 per cent in infected cases.
Meleney and Howes[6]	44 per cent
White[8]	53 per cent
Colp[5]	28 per cent
Madelung[25]	22 per cent
Grace[4]	41 per cent
Scherer	47 per cent
Erhardt	20 per cent

SIGNS AND SYMPTOMS

The signs and symptoms of disruption are few and manifest. Inspection of the wound may be negative or reveal only a slight fullness or the skin edges may gape. The presence of sanguinous fluid on the dressing is an important sign and should lead one to suspect the imminence of evisceration. Following some excessive strain, the patient may feel the sudden give of the wound. Pain may be present but is commonly absent. The accident may be sudden, or accompanying the preceding symptoms, a knuckle of gut or omentum is sometimes visible. Vomiting is occasionally present. Shock is usually absent but occurs at times when the evisceration is sudden or diffuse. White[8] points out that, "It is astonishing to note how quickly the final stage may occur and with what freedom from pain or discomfort." Horner[2] states that, "The commonest complaint is that of excessive moisture in the dressings. Even the binder and bed clothes may be drenched. The patient may feel the wound tear open or give way during a strain." Horner did not observe shock in his 3 cases.

PATHOLOGY

The pathology of disruption varies, depending upon how soon it occurs after operation and the degree of its progress.

Ordinarily there is a complete break through all the layers. However one occasionally sees protrusion of gut through a small opening, as in Case 1. Prolapse of the abdominal contents may be absent or the major part of the small intestine and omentum may be found on the abdominal wall and not unusually it is found adherent to the edges of the wound. Strangulation of a knuckle of gut has been also recorded. The discharge of fluid present is peritoneal transudate, unless infected and in most cases infection supervenes early. The catgut is usually found absorbed. This may be explained by the early dissolution and giving way of the suture which is bathed and digested in transudate or exudate, the peritoneal fluid. McCauliff[12] found that, "Practically all ruptures of fresh wounds show the peritoneum separated and retracted under the edge of the muscle." Immediately following the dehiscence, examination reveals bleeding only in the skin edges. White[8] clearly explains the sequence of events which supports our contention that early rupture must result from increased intra-abdominal tension when he states that, "The subcutaneous tissue long since has separated so that the disruption is completed when the silk is removed from the skin and the sole adhesive material is some new granulation tissue between the skin edges. If the deeper tissue separated at the same time as the skin edges, not only should there be fresh bleedings but the various layers would not have become adherent and overlapping with fibrinous exudate over all."

PROPHYLAXIS

Prophylaxis entails the close observance of surgical fundamentals including pre- and postoperative care, methods of suture, materials, and drainage. It is important to remember the safeguarding measures at our command in order to make the patient a better operative risk. This is sometimes difficult to attain in cases of emergency because of the time factor. The anemic individual may require whole blood transfusion; hypodermoclysis of glucosaline for toxemias, acidosis, dehydration, etc.; insulin therapy for the diabetic; building-up measures for malnutrition; kidney disease regimen; care of jaundice; etc. The fundamentals emphasized by Brandson and

Hillsman[28] are of paramount importance not only for preoperative but for postoperative care as well. They say in effect, that, transfusion restores serum protein; decreases capillary permeability and combats shock; that since 1500 c.c. of fluid supplies the normal needs of the body, the patient requires this amount plus the volume of fluid lost pathologically; that in severe trauma or prolonged handling of gut, this loss may be 35 per cent or, 1750 c.c. of the blood volume; that this also applies to preoperative vomiting, acidosis, etc. Details in technique are important in prophylaxis. Hayner[14] noted that "accumulation of blood and serum or liquid fat may hasten dissolving of catgut hence the importance of perfect hemostasis; of gentle sponging of fat . . . Excessively thick catgut invites exudation and infection." Tissue necrosis results when sutures are tied too tightly. Mattress sutures are best for the posterior sheath of the rectus muscle whose fibers run transversely. The importance of security in this fascial layer and the peritoneum is essential to sound closures. Despite the disadvantages of retention sutures previously mentioned, their value is apparent. Retentions may be through and through or only include the anterior layer of fascia. The former type entails the danger of including a piece of omentum or may cause adhesions by intraperitoneal irritation. Meleney and Howes[6] dissent in stating that if retentions only pass through the anterior layer of fascia instead of through and through, they have little effect against increased intra-abdominal pressure. The retention suture must be tied loosely and should not include too much tissue. The trend of opinion favors the removal of retention sutures on the twelfth day or even later. Baldwin[10] waits fourteen days and in so doing he claims that no eviscerations have occurred in 16,465 cases and that, "post-operative herniae are almost unknown." Prophylaxis against dehiscence, aside from the possible control of conditions which may cause increased intra-abdominal pressure, is the proper closure of the wound, proper cleansing of fascia of its areolar tissue and fat. Fascial union requires approximately twenty-one days and depends on the technic of suturing in which the important step is proper cleansing of the fascia. As a further precaution to insure firm closure, Dr. Fobes employs ox fascia grafts in cases where adverse conditions maintain, viz. weak abdominal wall, chiefly in the upper abdomen, etc.

The question of procedure in infected wounds is of great interest. Colp,[5] Horner[2] and others feel that infected wounds should be left wide open and packed with gauze. Colp advises against leaving the wound open only down to the fascia because, "the skin and subcutaneous tissues aid in the healing processes of the less vascularized fascia and the likelihood of fascial separations under adverse conditions is increased." The packing should be allowed to remain for ten days and when removed the granulations are so healthy that the skin may be approximated with adhesive. Farr's technic varies slightly. In several hundred cases of peritonitis and infection when the right rectus muscle splitting or retraction method was employed, the wounds were left wide open and packed with the Gibson-Mikulicz tampon. No sutures were used and the results were excellent. Evisceration was rare. The packing was removed on the fourth day and the rubber dam left in place. Clean and granulating wounds were nearly always present. There were no more postoperative hernias than in infected wounds treated by suture and drain. In cases of acute abdominal emergencies, Reid[3] used the following method. When any likelihood of infection was present, he employed through and through sutures of No. 20 gauge silver wire which were removed on the sixteenth to the eighteenth day. He claims that the advantages of this method of closure are security, rapidity, the abdomen can be closed under tension, the incision is easy to reopen by untwisting the wire; in peritonitis and infection drainage can occur between the sutures; the security

of closure allows the patient to get out of bed earlier; the incidence of postoperative hernia is no greater than in ordinary closures; and there has been no case of evisceration even when infection was severe. Reid's objections to the silver wire method are few: that pain is present in the incision because the wire is not as pliable as ordinary suture; there is some infection around the wire, but no greater than silkworm gut; and there is some cutting into the skin.

The choice of the type of incision is also of importance. Whenever possible one should choose the McBurney or Pfannenstiel incision since statistics reveal practically no dehiscence or hernia following their use. This further bears out the relationship of postoperative hernia to disruption. Indeed, the majority of patients with incisional hernias are unaware that they were on the borderline of evisceration soon after the primary operation!

A scultetus or snug abdominal binder is of aid in the security desired against disruptive forces. Its routine use should be advised.

TREATMENT

Treatment of disruptive is either operative or nonoperative, packing and adhesive strapping. When the patient's condition is critical and shock is present, the nonoperative procedure is preferable. This would also apply to cases with marked infection. The operative method generally employed is the placing of through and through nonabsorbable sutures. As has been previously noted, the earlier the treatment following disruption, the better is the prognosis. It is interesting to note the variations in technic among different operators. Horner[2] does not close the wound in the presence of infection. He covers the protrusion with perforated rubber dam and then applies a wet dressing. In a post cesarean with nephritic toxemia, cardiac decompensation and hypertension, under local anesthesia he covered the bowel with rubber tissue, inserted through and through sutures fixed to rubber tubing on each side. The rubber dam was gradually removed as the wound edges were drawn together. Lahey[9] believes that through and through sutures are strangulating and prevent good wound healing by causing infection, seratomas, etc. Freeman's[11] chief concern is in a secure closure of the peritoneum. In one of the responses to his questionnaire, McCauliff[12] noted a method of treatment in which a sterile dressing is placed over the evisceration and the patient is taken to the operating room in his bed. The intestines are then replaced under a small dose of spinal anesthesia. A Penrose drain is inserted and the skin edges are coaptated with wide adhesive strips. A nasal catheter to which suction is applied, completes the treatment. Another method depended upon the imbrication of the rectus sheath for its success. Starr and Nason[13] advise immediate resuture if no marked sepsis is present and the patient is in good condition. They employ spinal anesthesia because the resulting relaxation facilitates replacement of the viscera. The through and through suture is used and a drain is placed in doubtful cases. If there has been considerable handling of the bowel, they perform a Witzel enterostomy and bring the tubing through a stab wound. Shipley[23] favors local anesthesia and using through and through sutures of No. 22 silver wire, placing an ordinary bone button over each end of the wire which is tightened by twisting match sticks down on the button. The gut is protected with gauze which is removed as the wire is made taut. White[8] claims that braided silk is better for through and through suturing because it is more pliable, stronger, and less irritating. Meleney and Howe employ through and through sutures in clean cases. When infection is present, they treat the patient in his bed with heavy doses of morphine, replace the intestine, pack the wound with iodine gauze and draw the skin edges together with adhesive. If necessary, secondary sutures are used at a later date. Colp[5] lists the following methods of treatment:

1. Secondary sutures over a gauze drain;
2. Suture by layers;
3. Suture of peritoneum and packing rest of wound;
4. Packing without sutures;

Grace used the secondary suture in 30 cases and adhesive strapping with or without packing in 16 cases.

CASES OF EVISCERATION AT THE METROPOLITAN HOSPITAL

Case 1. Male, age thirty-eight years was admitted October 14, 1934, with a diagnosis of perforated peptic ulcer and discharged December 4, 1934. Abdominal pain was present about two hours after meals for nine days prior to admission and vomiting had occurred several times. Further relevant history revealed the presence of constipation, absence of blood in stools, no hematemesis and generalized abdominal pain. On the day previous to admission, the pain was so extreme that the patient fell down in the street. Fever and chills were present. The only other important part of the past history was that the patient had received only two months of antisyphilitic treatment ten years ago. Generalized abdominal rigidity with rebound pain and tenderness were the positive physical findings. Rectal examination revealed an enlarged prostate which was tender on the right side. The white cell count was 13,900 with 85 per cent polymorphonuclears and 15 per cent lymphocytes. The sedimentation rate on admission was 1 mm. in fifteen minutes and 4 mm. in an hour. The urine was normal. The postoperative laboratory findings showed a blood sugar of 137 mgms/100 c.c.; nonprotein nitrogen 40 mgms. and creatinine 1.9 mgms. The Wassermann reaction was negative.

Operation: An upper muscle splitting right rectus incision was employed under gas, oxygen and ether anesthesia. Free purulent fluid was found in the peritoneal cavity, but a culture showed no growth in forty-eight hours. The pus was aspirated with the suction pump. The perforation was located on the anterior surface of the stomach ½ inch from the pylorus. The opening was pursestringed and then plicated. This area was next covered with omentum which was anchored with fine catgut. A Penrose drain was placed in the right gutter and brought out at the lower angle of the wound. The peritoneum was closed with a continuous No. 1 plain catgut suture; No. 1 chromic catgut for both rectus sheaths, interrupted black silk for the skin and interrupted silkworm gut retentions including the anterior rectus sheath.

Progress Notes: Postoperative progress was uneventful for three days. The Sippy regimen was started on the fifth day. On the sixth postoperative day, during the interne's attempt at gastric lavage for relief of a slight distention, a violent coughing seizure resulted and was immediately followed by eviscertaion of four feet of small intestine *through the drainage opening*. No omentum was visible. Hot saline packs were applied. Shock was absent. The patient was taken to the operating room and under spinal anesthesia, the gut was replaced and a Witzel enterostomy was performed, bringing the catheter out through a stab wound in the right flank. Except for the original drainage opening which was about ½ inch long, the wound had healed firmly. A Penrose drain was inserted. The wound was closed with through and through dermol sutures. Hypodermoclyses of 1000 c.c. glucose and saline solution were repeated. In the following days the wound discharged pus profusely. The drain was gradually released. The retentions were removed after twelve days and the superficial area of the wound was cleansed and packed with vaseline gauze. The patient continued to improve and was discharged in good condition fifty days after admission.

DISCUSSION

We have failed to find any similar case in the literature of an evisceration occurring through a drainage opening. The intra-abdominal pressure must have been exceedingly great. Since the patient's condition was good prior to the accident and as no omentum was found in the vicinity of the disruption, it is unlikely that a knuckle of gut might have been adherent to the drainage opening which in turn might have served as a starting point for the evisceration. Therefore, we must attribute the accident to the violent coughing spell. The process of evisceration must have been almost immediate and not part of a previous series of pathological events.

Case 11. Male, age sixty-four years was admitted December 3, 1932 with diagnosis of a

ruptured peptic ulcer. He was discharged January 27, 1933. The patient was awakened by a sharp abdominal pain which radiated to the right shoulder, and followed by vomiting. There was a history of "indigestion" for 6 years with pain ½ hour after meals. Tarry stools were occasionally present. Physical examination showed a rigid abdomen with tenderness in the epigastrium only. The urine was normal. The white blood count was 12,400 with 80 per cent polymorphonuclears, 18 per cent lymphocytes and 2 per cent eosinophiles.

Operation: An upper right rectus muscle splitting incision was made under general anesthesia. A small perforation was located on the anterior surface of the pylorus. The rupture was purse stringed and a Penrose drain inserted. The wound was closed as before except that retention sutures were omitted.

Progress Notes: Distention was present during the first and second days. A Levin tube was inserted through the nose and a Harris drip and hypodermoclysis were given. Progress was uneventful until the eighth day when the sutures were removed and after a spasm of coughing evisceration occurred. The patient was taken to the operating room. After replacing the gut, the necrotic edges of the wound were excised, a drain inserted and the wound closed with through and through silkworm gut sutures. The patient's condition on the following day was poor and required a blood transfusion. For the next few days distention and vomiting were treated by the nasal Levin tube. The patient was discharged in good condition forty-seven days later.

DISCUSSION

Here again, increased intra-abdominal pressure was the cause of evisceration. Distention was present immediately after the primary operation. It is probable that the wound was weakened during the first two postoperative days. The final strain occurred during a coughing spasm which completed the evisceration.

Case III. Male, age fifty years, was admitted August 14, 1931 with diagnosis of chronic catarrhal gastritis, chronic interstitial nephritis, perihepatitis and peritonitis. He died October 17, 1931.

This patient was a readmission. In 1930 the left leg has been amputated for frost-bite gangrene. There was a history of untreated chancre thirty-five years ago. On admission the patient appeared undernourished. The positive physical findings revealed an irregularity of the left pupil which did not react to light or accommodation, carious teeth, fecal vomiting and a sensation of a mass at the pylorus. The patient's condition improved until September 3, 1931 when he complained of abdominal pain. At this time abdominal examination showed a right sided rigidity with slight tenderness. The stools were positive for occult blood. A gastric analysis was normal. The patient improved under atropine therapy. On September 11, 1931, gallstones and periduodenal adhesions were diagnosed by *x*-ray. The white cell count on September 28 was 15,000 with 68 per cent polymorphonuclears and 32 per cent lymphocytes. The hemoglobin was 70 per cent.

Operation: September 29 an exploratory laparotomy was performed through an upper right rectus incision under local anesthesia supplemented with gas and oxygen. A chronic productive gastritis, splenitis and hepatitis were found. The usual closure was employed.

Progress Notes: On the following day vomiting was frequent, the pulse was poor and a sanguinous discharge from the wound was observed. The measures employed were glucose and saline solution intravenously and gastric lavage. The vomiting and sanguinous discharge from the wound continued for three days. A supportive abdominal binder was applied. On the fourth day when the wound was dressed, it showed a gaping in the center and was bathed in a purulent discharge. The wound was cleansed and the skin edges were drawn together with flamed adhesive. The patient's condition improved although the wound continued to suppurate. Evisceration occurred on the twelfth day, although the sutures had not been removed. Hot saline packs were applied and heavy doses of morphine were given. The intestines were replaced and retained with iodoform packing. Flamed adhesive was used to coaptate the wound edges. The therapeutic measures employed were intravenous saline, hypodermoclysis and the nasal tube. Shock was present, the blood pressure was 88/58. The patient's condition improved during the next three days but he gradually began to weaken and died six days after the evisceration.

DISCUSSION

Early postoperative vomiting was the exciting factor in this case. Systemic disease was of importance because it predisposed towards this complication.

Case IV. Male, age fifty-five years was admitted March 21, 1934 and died April 4, 1934. He was admitted for an exploratory laparotomy because of an eight months history of vomiting, only a fluid or soft diet being retained. Physical examination showed an undernourished male but not acutely ill. The pupils were irregular and reacted sluggishly to light and accommodation; the teeth were in poor condition; anterior cervical adenopathy was present and the lungs were emphysematous. The abdomen was normal except for a complete left inguinal hernia which was easily reduced. The abdominal reflexes were absent and abnormal reflexes such as bilateral ankle clonus, patellar clonus, positive Babinski and Oppenheim were present. Arteriosclerosis were marked. The urine showed granular casts and a tract of albumin. The Wassermann test was negative.

Operation: April 2, 1934. A left Bassini repair was performed followed by an exploration through an upper left rectus incision. Except for visceroptosis of the stomach and colon, no pathology was found. The usual abdominal closure was done including retention sutures.

Progress Notes: The patient's condition was excellent until the fifth postoperative day when he became irrational and *got out of bed.* Restraint was necessary. However, recovery followed within twenty-four hours. The sutures were removed on the ninth day and the wound appeared clean and healed. A few hours later, evisceration occurred suddenly. An intravenous of saline solution was given and the patient was removed to the operating room. The wound was closed with through and through silkworm gut sutures and a Penrose drain inserted. On the second day after the secondary operation death ensued due to cardiac failure.

DISCUSSION

This case illustrates another type of increased intra-abdominal pressure namely, getting out of bed soon after operation. The disruption probably started when this event took place although the actual evisceration occurred four days later following removal of the skin sutures.

Case V. Male, age forty-eight years, admitted March 7, 1934 for ruptured peptic ulcer and died March 21, 1934. This patient was a readmission. Diagnosis of peptic ulcer was made in December, 1933 and a Sippy regimen advised. The pain present on admission started two weeks previously. Physical examination showed an undernourished male not acutely ill, the carious teeth and pathological abdominal signs.

Operation: March 21, 1934. The abdomen was opened through an upper right rectus incision. Pyloroplasty and appendectomy were performed. The wound was closed in layers and silkworm gut retention sutures.

Progress Notes: The postoperative course was uneventful until the fourth day when the patient became dyspnoeic, coughed and developed tracheal rales and abdominal distention. Signs of pneumonia were obvious. Improvement followed. On the eighth postoperative day, evisceration occurred suddenly. Shock was present. An intravenous of 500 c.c. of acacia in saline was given. The patient was taken to the operating room and under spinal anesthesia the intestines were replaced, the wound drained and then closed with through and through silkworm gut sutures. His condition was poor and another intravenous was given followed by a blood transfusion the next day. Bilateral moist rales were present. He became semicomatose, irrational and died on the ninth day after the primary operation. The sputum was classified as pneumococcus type IV.

DISCUSSION

Distension and cough were responsible for the evisceration.

Case VI. Female, age fifty-two years was admitted April 29, 1933 for cholecystitis and chronic cardio-valvular disease and discharged June 4, 1933. The history of pain in the right upper quadrant was of one year's duration. Thyroidectomy was performed two years prior at the time of the menopause. Physical examination showed an obese female not acutely ill. The heart was slightly enlarged, the sounds distant and the first mitral accompanied by a systolic murmur. The abdomen was slightly

rigid and tender in the right upper and lower quadrants.

Operation: May 3, 1933. The gall bladder and appendix were removed through an upper right rectus incision. The wound was closed in layers, no retentions being used.

Progress Notes: Vomiting, retching and distention were present for four days after operation. The sutures were removed on the eighth day and it was observed that the wound had healed by primary intention. On the tenth postoperative day there was a sudden evisceration of intestines and omentum through the widely disrupted wound. The patient was removed to the operating room where the wound edges were curretted and then closed in layers and silkworm gut retentions. Recovery was uneventful and the patient was discharged in good condition thirty-seven days after the primary operation.

DISCUSSION

Undoubtedly, the increased intra-abdominal pressure due to the vomiting, retching and distention present during the first four postoperative days caused the evisceration which became apparent later.

Case VII. Female, age twenty-three years, was admitted March 8, 1932 with a diagnosis of bilateral oophoritis. She died March 23, 1932. The patient complained of pain in the right lower quadrant of one week's duration and amenorrhea for one year. Menstruation was irregular since 1925. She was married eight years ago; she had had no pregnancies but one miscarriage. On physical examination the abdomen was found markedly obese and the right lower quadrant was slightly tender. Gynecological examination showed a small uterus, enlarged right ovary and tenderness in the right fornix.

Operation: March 16, 1932. A lower right rectus incision was employed. Many peritoneal adhesions were present and a few strong bands were freed. The wound was closed in layers using Michel clips for the skin and silkworm gut retentions.

Progress Notes: The patient's condition was poor immediately following the operation. Her temperature varied between 104° and 106°F. until her death on the seventh day. Generalized erythema and pruritus were present on the second day. The throat was injected. Moderate distention was noticed throughout. Diarrhea was marked on the fourth day. Sudden evisceration occurred on the sixth day, the wound discharging much purulent fluid. The patient was removed to the operating room and after inserting a Penrose drain, the peritoneum and muscles were sutured with No. 2 chromic catgut. The superficial wound was packed with iodoform gauze. Death occurred on the following day.

DISCUSSION

Although distention was moderate, the increased intra-abdominal pressure was sufficient to cause evisceration. The treatment for the disruption was probably ill advised. It would have been better to treat the patient in her bed by the packing and adhesive technic.

Case VIII. Male, age fifty-six years, was admitted January 21, 1932 with a diagnosis of chronic cholecystitis. He died February 16, 1932. There was a history of sudden pain in the upper right quadrant, the first attack occurring one month and the second two weeks previously. Anorexia, flatulence and belching were present. Physical examination showed an obese male suffering from acute upper right abdominal pain. The epigastrium was tender and rigid; also tenderness over McBurney's point. The heart sounds were distant. His blood pressure was 150/98.

Operation: January 30, 1932. The gall bladder was removed through an upper right rectus incision. The wound was closed in layers and dermal retention sutures.

Progress Notes: Marked vomiting persisted for eleven days when evisceration took place. In spite of gastric lavage this complication of vomiting and distention continued. The wound bled profusely on the fourth day. Pain was present prior to the disruption. After the accident occurred, the protruding omentum and intestines were covered with saline packs and the patient was removed to the operating room. The wound edges were found to be dirty grey and necrotic. Two Penrose drains were inserted. Several No. 2 chromic catgut through and through sutures were used for the closure. A Levin nasal tube was inserted on the following day but distention persisted and dyspnoea was marked. Gurgling rales were present in both bases, the heart sounds were distant, and fecal

incontinence supervened. Bleeding in the wound recurred, therefore an abdominal binder was securely adjusted. The patient became irrational, gradually weakened and died on the sixteenth postoperative day.

DISCUSSION

Increased intra-abdominal pressure played a prominent role in the evisceration. Following the secondary suturing, bleeding recurred and it is likely that another disruption would have followed had not death occurred.

SUMMARY

Increased intra-abdominal pressure is the primary factor in the etiology of evisceration and avulsion of abdominal wounds. Other causes mentioned under etiology play only a contributory part. Eight cases of evisceration are reported in all of which increased intra-abdominal pressure was conspicuous. Prophylaxis entails a close observance of the fundamentals of surgical technic and principles. The symptomatology and treatment are presented.

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SUBPERITONEAL DECORTICATION IN GALL-BLADDER DISEASE

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THE recent death of Dr. Eugene Louis Doyen, at the early age of fifty-seven, removed a well known figure in surgical circles which was not limited to Paris. Despite the fact that he was unattached to any large hospital or teaching institution, his views on the etiology and treatment of cancer attained worldwide publicity. The micrococcus neoformans, which he first observed in cancerous lesions in 1886, was the causa causans of cancer according to his own belief based on his personal demonstration. A paper written by Drs. A. Paine and J. Morgan, contributed from the Cancer Hospital and published in the Lancet in 1906, was accepted by British observers as conclusive proof that the French discoverer was in error. Nevertheless, Doyen's work was honest and painstaking even though the non-fulfillment of his expectations caused him to become involved in violent conflicts in Cival Courts and with members of his profession. Doyen has been credited as being the pioneer of the cinematograph method for teaching surgical technique. Some of his operations were undoubtedly presented in this manner in 1898.

Doyen used rapid and sensational operative procedures which included the cinematographic method of operation quite similar to the technique of César Roux who was the pupil of Kocher and who eventually excelled his own teacher.

In 1899, Doyen removed a gall bladder subperitoneally, then instituted drainage through the resulting peritoneal sac. He termed this operative procedure "subperitoneal decortication." At about the same time Kehr became dissatisfied with the raw area in the liver resulting in the accepted technique of cholecystectomy including drainage of the common duct by choledochotomy. A combination of these two operative procedures was the operative technique that he described. He invariably used the Kehr incision. Unfortunately, he attempted to use a subhepatic tampon to create a subhepatic barrier by means of inflammatory adhesions, formed at the expense of the neighboring viscera, thus permitting the subhepatic drain to emerge. In 1908, Professor Louis Tixier of the Surgical Clinic of the University of Lyons, France, modified the Kehr method and utilized a simple continuous serous tunnel to hold the drains and the Kehr T-tube for draining the common duct. Kehr adopted the term "subserous resection."

Surgeons should study the Doyen technique, familiarizing themselves with the advantages the subperitoneal procedure offers. This operative method should be applied to all serious and highly inflammatory gall-bladder conditions where performing a cholecystectomy is questionable owing to the pathological condition in and around the gall bladder. This is especially true in cases where the denudation is so extensive that it would result in the exposure of a large absorptive area.

When confronted by such a condition evidencing a serious blood chemistry, indicated by the high increase of cholesterol and esters, bile acids, icterus index, urea, glucose, and uric acid, the author believes that Doyen's procedure is the operation of choice, inasmuchas, the surgeon experiences slight difficulty in pealing off the serous membrane. Undoubtedly, many surgeons will disagree with this opinion. The late John B. Deaver never mentioned

this technique in either his medical writings or his textbook. In severe cases of gall-bladder disease he always advised cholecystostomy. Drainage of the gall bladder has never appealed to the writer, since the postoperative adhesions are so serious that a future cholecystectomy results too often in a high mortality. The retained highly infected mucosa frequently develops into a persistent sinus or a retention of infected material which does not drain.

Kocher designed a hollow sound that greatly facilitated the subperitoneal dissection of the gall bladder. A short time later von Haberer modelled a dissector which he claimed was an improvement of the Kocher instrument.

Elgart reported the removal of the mucous membrane from the body of the gall bladder and curetting the gall-bladder neck in cases of cholecystitis that evidenced a thickened wall and adhesions between the gall bladder and the colon. This endectomy may be indicated in any chronic or acute cholecystitis if the walls of the gall bladder are not gangrenous and the fever is not high.

Von Haberer's modification of the Kocher hollow sound facilitates dissection in those typical cases where a massive infiltration exists in Cabot's triangle. A subserous cholecystectomy should be employed in order to preserve the cystic duct.

SUMMARY

In conclusion, the author believes that subperitoneal decortication is the operation of choice in cases of extremely serious and highly inflammatory gall-bladder conditions. This is especially true when denudation of the liver surface is extensive, resulting in the exposure of a large absorptive area and the blood chemistry indicates the acute and dangerous condition of the patient.

Not only would this operation lower the attendant mortality, but would also spare the patient from further dangerous operative procedures occurring in the secondary operative removal of the gall bladder as, for instance, following a cholecystostomy.

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TREATMENT OF ACUTE HEAD INJURIES

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MUCH has been written on the subject of head injuries but it is the duty of those who have had unusual experience in this type of injury to express the progress of their observations and conclusions for mutual benefit. An injury to the head or brain does not require the neurosurgeon exclusively, for the average head injury must be treated by the nearest available doctor regardless of his specialty. Every doctor who is likely to be called in such an emergency should have certain definite rules to follow.

The following suggestions are offered as a working guide for those who do not have neurologic aid at their disposal.

All head injury patients may be classed under three groups: (1) those who will recover regardless of the treatment; (2) those who will die in spite of all treatment; and (3) a small group in which the outcome will be entirely dependent upon the treatment employed. In most cases during the first twenty-four to forty-eight hours it is impossible to determine in which group a certain patient belongs.

Most head injury patients constitute a medical rather than a surgical problem, 10 per cent or less requiring surgical treatment. Those few that require surgery during the first to the fourth day may need an operation for one of the three following conditions: (1) a compound fracture of the vault of the skull; (2) a ruptured middle meningeal artery; (3) a simple depressed fracture over a motor area or over the speech area of the brain cortex.

A patient just brought into the receiving ward with evidence of head injury presents bruises or cuts over the head, bleeding from the nose, mouth or ears, discoloration and swelling about the eyes, a state of unconsciousness or a history of a period of unconsciousness immediately following the injury.

Immediately the patient is made warm and quiet. Some head injury patients lie very still while others are restless. This is harmful and must be controlled as soon as possible. Morphine should not be used, as this drug tends to increase the swelling in the already swollen brain. Very frequently morphine increases the restlessness. In most patients rectal instillation of 3 to 6 grains of sodium amytal will quiet them in a few minutes. This dose can be repeated as often as needed to control restlessness. As much as 24 grains has been given in twenty-four hours over a period of several days without harmful results. In a patient who is unusually violent the sodium amytal may be supplemented by ½ grain codeine sulphate, which does not have the harmful effect of morphine. In the case of an unusually violent patient, an ampule of sodium amytal, (7½ grain) may be injected intramuscularly.

As soon as the patient is quieted, all active hemorrhage must be stopped either by gauze packs or ligation. No attempt at suturing or repairing wounds should be made until the patient is out of shock.

Every patient who had had a head injury sufficient to cause unconsciousness is suffering from edema of the brain and the next step is to try to reduce this edema. This is best accomplished by the intravenous administration of 50 c.c. of a 50 per cent solution of glucose, repeated every four to six hours until the patient regains consciousness. In children in which it is difficult to find a vein, or in any patient in which the venous puncture increases the restlessness, dehydration of the brain may

be produced by rectal instillation of two to three ounces of a saturated solution of magnesium sulphate. Of course, one would not give the magnesium sulphate per rectum at the same time that sodium amytal is inserted, but one-half to three-quarters of an hour later.

By this time, someone will most probably demand to know why we do not hurry and have an *x*-ray picture taken to determine whether or not the patient has a fracture of the skull. It is usually very difficult to satisfactorily explain to the family and friends that in the great majority of head injuries we are not in the least concerned about a fracture, that our chief care is the degree of trauma to the brain and that every injured brain needs rest more than anything else. As observation of the patient is continued, circumstances may arise which will make it necessary to have an *x*-ray plate of the skull. These circumstances will be considered as we proceed.

After the patient has been made quiet and has received intravenous glucose or magnesium sulphate per rectum, the head is inspected for wounds. If there are no scalp wounds, or if there are wounds that do not extend to the bone, we can conclude that the patient does not have a compound fracture of the vault of the skull, and therefore surgical treatment, at least for the present, is not indicated. On the other hand, a fracture of the skull may be seen through a scalp wound and we can conclude that an operation will probably be necessary as soon as shock has subsided. Again, a small scalp wound may extend to the bone, but the size of the wound interferes with proper inspection of the neighboring region of the skull. In such a case the possibility of a compound fracture of the vault must be kept in mind and an *x*-ray of the skull should be taken as soon as the patient's condition permits. Thus with our first observations of the patient we can determine whether the treatment will be surgical or non-surgical during the next few hours.

Let us consider first the patient without a compound fracture of the vault. Since no immediate surgical treatment is indicated, our chief duty is to keep the patient quiet and the brain dehydrated. A neurological examination is of little value during the first few hours. Certain features, however, should be observed and noted. Bleeding from the mouth or nose often means a fracture of the frontal fossa of the skull. With such a condition present, the patient's head should be turned to one side so that the blood that runs back into the throat will not interfere with breathing. A mechanical aspirator to remove the blood and mucous from the pharynx is often helpful. Bleeding from one or both ears practically always means a fracture of one or both middle fossa of the base. The only treatment for this is to place a sterile gauze over the ear to prevent the entrance of dust. Edema or hemorrhage of the conjunctiva generally means a fracture of one of the orbital bones. Swelling and discoloration of the eyelids may or may not indicate fracture. For such swollen and discolored eyes cold, wet compresses are advisable. The size and reaction to light of each pupil should be determined and recorded; not that these abnormalities can be remedied, but subsequent pupil changes may be of considerable diagnostic value. The patient should have a gentle inspection of his entire body in search for other injuries. The pulse, respiration, blood pressure and temperature should be recorded at hour or half-hour intervals; these findings do not aid very much in indicating the line of treatment, but they do point towards the prognosis.

As soon as the patient is out of shock, which in the average case is usually between two to four hours after the injury, the question of lumbar puncture is to be considered. Some believe this to be an important therapeutic measure while others insist that it should never be done in head injuries. I feel that the "anti-lumbar puncturists" do not realize the real significance of this procedure. If a lumbar puncture were done with the sole purpose

of reducing intracranial pressure, it would be of practically no value because the intracranial pressure following head injuries is due chiefly to hemorrhage and edema in the brain substance and these can not be modified very much by the withdrawal of cerebrospinal fluid. The only reason for performing a lumbar puncture in a head injury patient is to remove blood from the subarachnoid spaces. Those doing general surgery are constantly reminded of the harm resulting from blood being left in cavities and tissue spaces where it tends to form adhesions. The stiff elbows and knees following mild injuries are most often due to adhesions secondary to blood in these joints. For this reason, blood should not be allowed to remain in the subarachnoid spaces where it may form adhesions and thus interfere with the normal flow of cerebrospinal fluid. Such blockage tends to produce varying degrees of chronic edema of the brain, which in all probability, is an important factor in the later symptoms following head injuries, such as headache, dizziness, sleeplessness and general nervousness.

For this reason most head injury patients should have a lumbar puncture as soon as they have recovered from shock. Those who should not be punctured are those who have a compound fracture of the vault of the skull or a compound fracture of the base, as evidenced by bleeding from the nose, mouth or ears. The reason for this is that in reducing the pressure in the subarachnoid space, even the slightest degree, a negative pressure might be established in the region of the fracture and thus infected material might be sucked in through the rent in the dura and produce meningitis. Again, a lumbar puncture should not be done on a restless patient and thus increase his restlessness.

In most patients a spinal puncture can be done without pain if the area is first infiltrated with a 2 per cent novocain solution. If the fluid obtained is perfectly clear and free from blood, the needle can be withdrawn, as further removal will be of little or no value. If the spinal fluid is bloody, enough should be removed to make the spinal pressure about one-half of the original pressure. If a spinal manometer is not at hand, a glass tube 12 to 18 inches long with a rubber tube to connect with the spinal needle is all that is needed. The relative pressure as compared with the original pressure found on first obtaining the fluid, is all that is necessary. When the spinal fluid is found to be bloody, this procedure is repeated every twenty-four hours until the fluid appears clear. This may have to be continued for several days, even after the patient has regained consciousness.

The physician may now leave the patient in the care of an attendant with instructions as to sedatives and dehydration. The patient should be watched constantly and the findings recorded. A rapidly mounting temperature to 103°F. or over indicates a very grave prognosis. An increasing blood pressure combined with a reduced pulse rate may indicate an increasing intracranial pressure, but the absence of these signs are not a reliable indication that the intracranial pressure is not increasing. Cheyne-Stokes respiration means increased pressure extending to the medulla. The most important signs for which one has to watch are evidences of cortical irritation plus those of an increasing intracranial pressure, as these may point to the formation of an extradural hematoma.

In this group of patients, apparently non-surgical at the start, our chief concern during the first forty-eight hours is the possibility of an increasing intracranial hemorrhage. This bleeding may occur in the brain substance, over the surface of the cortex, or in the extradural space. If the hemorrhage is in or on the brain, little or nothing can be done about it, but if the hemorrhage is in the extradural space from a ruptured middle meningeal artery, an early operation is imperative in order to stop the bleeding and save the patient's life. It is very important to keep

this possibility in mind and to be on the lookout for its occurrence. The chief points to consider are the following:

The patient may have regained consciousness and then lapsed into unconsciousness. This latent interval is very suggestive. With the gradually increasing hematoma, pressure will be exerted over the motor area, frequently leading to one-sided convulsions affecting the face, an arm or leg, or the entire side of the patient. In some cases convulsions are absent, but the side opposite the hemorrhage becomes spastic and frequently followed by a complete flaccidity of the paralyzed side. While these motor changes are taking place, there may be stertorous breathing with Cheyne-Stokes respiration; a rise in blood pressure with a slowing of the pulse and often the pupil on the side of the hemorrhage, which was previously mobile or contracted, will become dilated and fixed. In practically all middle meningeal hemorrhages, there has been a fracture of the temporal bone. Bleeding from an ear combined with these findings would warrant exploring the injured temporal fossa, but absence of bleeding from an ear does not mean that the artery could not have been ruptured higher up. In such a condition with the signs of a localized increasing cortical pressure, we are finally justified in taking an *x*-ray plate of the skull. If no fracture is present in the region of a meningeal artery, we can conclude that the pressure is due to a subdural pathology and an exploration is not indicated. If, however, a fracture in either lateral surface of the skull is found, the subdural space should be explored.

A subdural hematoma from a ruptured middle meningeal artery is a rare occurrence and one that probably is overlooked frequently. As a rule, when such a condition is suspected, it is safer to make a small trephine opening under local anesthesia and explore the temporal fossa than to allow such a condition to progress unrecognized.

Assuming that the patient has showed no signs of meningeal hemorrhage, the treatment still continues to be that of keeping him quiet, reducing cerebral edema and spinal puncture if indicated. Some patients in this group will continue to grow progressively worse and there is practically nothing further that can be done. Others will show signs of regaining consciousness. As soon as they can swallow, they may have water and other liquids in limited amounts. Many patients, however, remain unconscious for days and even weeks, and then we have the problem of feeding. A good rule is the following: After the first forty-eight hours if the patient is still unable to take food, he should be gavaged with a mixture of one raw egg, two ounces of glucose or sugar, ten to fifteen grains of sodium chloride and one ounce of magnesium sulphate the whole mixed with enough milk to make a pint. This should be repeated each day until the patient is able to swallow food.

After a few days, when the patient seems on the road to recovery, it will be time to take an *x*-ray of the skull. In most instances, the only reason for doing this is to satisfy the family and for academic interest. Occasionally, a simple, depressed fracture may be found, but this seldom requires elevation unless the depressed bone is over a motor area, or over the cortical speech center. Depressed bones over other regions of the cortex seldom if ever cause harmful pressure.[4–5]

When the average head injury patient regains consciousness, he is generally restless to be up and going. A patient who has been unconscious for a period of three hours should stay in bed for at least one week. A good general rule is to keep the patient in bed one week for each three hour period of unconsciousness. Any form of activity started too soon is harmful to these patients, but many have to be convinced of this from their own sad experience.

While the patient is convalescing and often for months afterwards, he should limit his fluid intake. The reason for this

is that following a head injury, it is very easy to get a recurrence of edema of the brain. Any excess of fluid tends to produce this condition. Most patients recovering from a severe head injury should limit all fluids to twenty-five to thirty ounces in twenty-four hours.

We now return to the patient as we first observed him and will assume that he belongs to the group with a scalp wound suggesting a compound fracture of the vault. While sponging and cleaning the depth of the wound, we may see a depressed or linial fracture. This generally means that an operation is indicated as soon as the patient's condition warrants it. Before preceding with the operation, it is best to have an *x*-ray of the skull in order to determine the exact shape and extent of the fracture. This condition is the only type of head injury that requires an *x*-ray soon after the accident.

The only reason for operating upon a compound fracture of the vault of the skull is in the hope of preventing infection, resulting in either abscess of the brain or meningitis. The operation consists in doing a debridement, removing dirt and other foreign material, and removing enough of the bone fragments to inspect the underlying dura, which if found torn should be tightly sutured. The remainder of the wound is closed in layers without drainage.

There are instances in which even a compound fracture of the vault should receive nothing more than a gentle debridement with closure. Such cases are those in which the compound fracture is over one of the large dural sinuses. In such a case a depressed fragment may be plugging a tear in one of these venous sinuses, and on elevating the fragment a fatal hemorrhage may result. Confronted with such an alarming situation, the only thing to do (except for the most experienced) is to pack the wound with gauze and withdraw. For this reason, a compound fractive over a venous sinus had better be handled in a very conservative manner, because the danger from meningitis is less than the danger from an alarming hemorrhage.

SUMMARY

In the case of acute head injury, our main concern is to keep the injured brain as quiet as possible. Edema of the brain should be combatted by means of dehydration. Blood in the subarachnoid space should be removed.

Compound fractures of the vault of the skull should be explored and the dura closed, except in those cases where the fracture is over a venous sinus. Signs of a ruptured middle meningeal artery should be explored as soon as suspected.

Simple depressed fractures of the skull are of little significance and require no treatment unless they are over a motor area or the speech area of the cortex.

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DIAGNOSIS AND TREATMENT OF ECTOPIC (TUBAL) PREGNANCY

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HAVING successfully treated eleven successive cases of ectopic (tubal) pregnancy in the last few months, I would like to review briefly the symptoms, diagnosis and treatment of this rather dangerous emergency.

Etiology. In brief anything which prevents the normal decent of the ovum to the uterus is quite liable to cause a tubal pregnancy. The uterus responds to the hormone stimulation early in ectopic pregnancy, as when the pregnancy is in the uterine cavity. The uterus is enlarged softened and all its elements become hypertrophied. True decidua forms in the uterus and continues until the ectopic pregnancy is disturbed by death of the ovum or external or internal rupture; the decidua then degenerates, bleeds and is cast off. This fact explains why in an ectopic pregnancy the uterus is enlarged practically the same as in the normal pregnancy.

There are two schools of thought as to what the primary causes might be, whether it is the ovum or the tube itself.

The first group believe the cause is in the ovum and explain it by the "Site of Fertilization." The work of His, Bischoff and Strassman would seem to indicate that it occurs in the fallopian tube. If this is true, then every pregnancy begins extra-uterine and ectopic implantation may be said to be due to retarded advance of the fertilized ovum.

The second group believe it is due to obstruction which may be: (1) pressure of tumors; (2) adhesions or inflammatory masses in the pelvis; (3) salpingitis. In my experience this form of infection was present in a large percentage of cases. I believe that in a number of cases a careful history would reveal this to have occurred some months or years previous to the ectopic pregnancy. Salpingitis destroys the cilated epithelium of the tube and narrows the lumen.

Decidua vera or parietalis formation takes place in the uterus; and only small isolated islands of decidua are found in the tube. Implantation occurs in the usual way by the eroding action of the trophoblast bringing chronic villi into the direct contact with tubal musculature. The rapidity of cell division of the ovum by which it may become too large for the tubal lumen is not definitely known, nor how soon it reaches the trophoblastic stage in which it has the power to digest its way into the tube wall, nor do we know the amount of membrane granuloma which may adhere to the ovum making passage difficult. As the ovum developes it bulges into the tubal lumen, pushing part of the tube wall before it. Then it comes in contact with the opposite wall, this is stretched and bulges into the opposite direction, the whole lumen being greatly dilated.

Diagnosis. The diagnosis can be roughly divided into three divisions.

(1) Before rupture; (2) beginning rupture or abortion; (3) after rupture.

The term rupture includes internal rupture or tubal abortion as well as rupture through the tubal wall. Symptoms of early ectopic pregnancy may simulate any abdominal condition and the best diagnosis is made by a complete and careful history. In taking the history inquire as to the sterility; if the patient has been married for several years and never became pregnant or even if a one child sterility is present, it should be a hint. Previous laparotomy especially if the patient had a conservative operation and the tubes are present is suggestive; previous pelvic infection is found in a large number of cases.

Abnormal Menstruation. A missed period is always a presumptive sign of pregnancy but a patient often wants "To wait until next month and see if menstruation will take place then." Some believe they are normally pregnant and wish to wait until next month before consulting a physician. Postponed, prolonged or otherwise abnormal menstruation are very suggestive.

Authorities quote different figures in the history of menstrual disturbances, ranging from 81 per cent of Howard Taylor to 96 per cent of Polak, the latter reviewing 271 cases. This figure, in our experience, is more nearly correct as we found a history of some menstrual trouble in each case. However, some patients take no notice of their menstrual periods.

Subjective symptoms and vaginal bleeding are rare before rupture, small cramp like pains, slight discomfort and soreness are some of the complaints, but are not severe enough to consult a physician.

Pelvic Examination. Authorities say that the cervix is likely to show a little softening and slight discoloration at this stage, however, in the cases I have seen before rupture I have not been able to definitely demonstrate this. The uterus is slightly enlarged and softened, but Hegar's sign and characteristic feel of the pregnant uterus are lacking. A mass is difficult to feel at this stage and is more often missed than found. There is no blood in the peritoneal cavity, so no fever or leukocytosis is present. In fact all symptoms are so moderate and the physical findings so vague that the physician who makes a diagnosis at this stage should consider himself fortunate. Recently by the use of Ascheim-Zondek reaction presumptive pregnancy may be ascertained, however, this is not 100 per cent true.

Clinically the best time to make a diagnosis is at the beginning of the rupture or abortion because operation can be done before any dangerous hemorrhages occur. The symptoms are very similar to those before rupture except that they are more definite.

Intermittent, irregular, brownish red and unclotted bloody vaginal discharge, dribbling or spotting in character, is one of the significant signs of beginning rupture, abortion, or death of the ovum. Rarely the bleeding may be quite profuse and clotted.

Pain. According to Wynn, pain occurs in 84 per cent, Farar states 96 per cent; in our cases it occurred in all but one. The pain is cramp like, sharp, stabbing and if on one side of abdomen points strongly toward tubal pregnancy and is a very important point in diagnosis in this stage. Even soreness or pain on defecation if not present previously must not be overlooked. If this pain is followed by relief for a few hours, several days, or even weeks then recurring, it is a very significant fact.

Physical examination at this stage will show an enlarged soft uterus, so that differentiation must be made between a normal and a tubal pregnancy. If tubal both Hegar's and Brawn Van Ferwald's signs are absent. The cervix is somewhat softened and slightly dilated. Some authorities say there is a bluish color of the cervix, but in many cases this was not marked. Before rupture the mass is small but as it increases in size from hemorrhage or growth of the ovum it can be felt at either side, behind or sometimes in front of the uterus. It is tense and very tender. Enlargement of this mass means increased bleeding and should warn that rupture may be expected.

Generally the physician is not called until rupture has occurred, or if the physician has seen the patient previously, expectant treatment for too long a time is often advised. After rupture occurs the diagnosis is not difficult to make. Patient has severe pain, is pale, in marked shock, her pulse is rapid and weak, a very low or absent blood pressure reading, and her abdomen is rigid. Emergency measures, a rapid operation and transfusion are the methods of treatment.

Laboratory Findings. In these cases the hemoglobin and blood count are usually low due to the hemorrhage. The white

count is increased because of the free blood in the peritoneal cavity.

Treatment. Treatment is surgical; there is no other.

When a patient is seen before rupture occurs an ordinary laparotomy should be done and the tube removed. If the patient is in very good condition the appendix or any accompanying pathology can be excised.

After tubal rupture the patient is in severe shock and a large hypodermic injection of morphine should be given immediately. An intravenous solution should be started before the operation. The patient should be operated rapidly and the bleeding tube removed. Nothing else should be done in the abdomen.

An autotransfusion should be given at the same time if no infection is present. As soon as the patient is in the hospital donors should be typed for blood transfusion which should be given simultaneously or immediately after operation. Donors should also be available for possible transfusion repeated several hours later as a reaction occurs a few hours postoperatively and this crisis may be overcome by a second blood transfusion.

Anesthesia. I have found spinal anesthesia very successful as it prevents the patient from struggling, this prevents increased bleeding, a very important factor in excessive hemorrhage. I have used it in the cases of marked shock and almost absent blood pressure with no ill results, and can highly recommend it to those who understand the technique of its use.

Following is a brief review of the 12 cases:

Case I. M. H., admitted February 6, 1934.

History. This patient had missed one menstrual period in August, 1933. In September, 1933 she had some bleeding for two weeks with regular pain on left side. Diagnosis of probable ectopic pregnancy was made by two physicians but she refused operative interference. She was referred to us the latter part of January, 1934 for pelvic discomfort. Abdominally there was some tenderness above the left rectus muscle. *Vaginal examination* revealed some irregularities of the uterus and a small mass in the left adnexal region.

Operation. February 7, 1933. The left tube was enlarged to four or five times its normal size, gangrenous in its distal half and contained a small mass which was probably a former ectopic pregnancy which had died. The left ovary was cystic and contained a large hemorrhagic cyst. There were two subserous fibroids in the uterine wall. The appendix showed evidence of chronic infection. A few adhesions were around the right tube and ovary but the tube and ovary were not pathological.

Pathological diagnosis: Ectopic pregnancy.

The patient made a good recovery.

Case II. K. G. was admitted March 3, 1934.

History. Four years ago patient had an ectopic pregnancy in right tube and was operated. Her last menstrual period was February 6, 1934; the previous period was on time and of usual duration and amount. Since her last period she has had irregular bleeding and passed a few clots, three weeks previously. The last week or so she had nausea in the morning and cramp like pains in the left lower quadrant.

Vaginal Examination. The patient was somewhat tender from her former operation. Examination was very difficult because of much tenderness of the uterus.

Operation. There was a midline scar in the abdomen from a former incision. Findings were an ectopic pregnancy of the left tube which had ruptured with a large clot of blood, about three inches in diameter in the left side. There were many adhesions to the loops of ileum from the former operation. The appendix was buried beneath the cecum and showed evidence of a former infection. The left tube and the appendix were removed.

Pathological Diagnosis. Ruptured ectopic pregnancy.

The patient left the hospital in good condition.

Case III. H. M., admitted October 8, 1934.

History. Onset about one week before admission with severe cramps in lower abdomen, worse on the left side. These became much worse about four days before admission when she was seized with a sudden severe pain in left lower abdomen and became weak and had a severe chill. Last menstrual period was August 20, and was normal; no menses on September 20. Following the severe pain and chill began

to have some vaginal bleeding which was darker in color than normal. Two days before admission she had more pain and chills, the pain then becoming steady with increased soreness but without cramps.

Vaginal Examination. Tenderness of uterus on palpitation and fullness in the left tube were palpated.

Operation. Slightly enlarged uterus with dilated cervix which on curetting yielded decidual membrane. There was a pregnancy in the left tube at its distal third and a large blood clot in the abdominal cavity. In the lower portion of the abdominal cavity was blood clotted. The cecum was somewhat adherent and the appendix was slightly injected and enlarged.

Pathological Report. Left tubal pregnancy.

The patient made a good recovery.

Case iv. F. S., admitted October 20, 1934.

History. Patient missed one menstrual period and took quinine in an attempt to abort. One week ago she began to bleed which she thought was her regular monthly period but had not bleed for twenty-four hours previous to her attack. She had cramp like pains in her abdomen and fainted while preparing to go out. Her husband called a physician on the telephone asking his advice for her fainting, but did not tell the physician anything of her past experiences. The physician suggested her remaining in bed.

She remained in bed, the abdominal cramp like pains continued and she became very weak. In the morning she was hospitalized.

She gave practically a negative history except having missed one period. She had two normal previous deliveries.

Operation. Under spinal anesthesia the abdomen was opened and a tube ruptured near the junction of the uterus was found. The tube was removed and 1,000 c.c. free blood was used for an autotransfusion. Patient was returned to bed in fairly good condition. A few hours later 600 c.c. of whole blood given intravenously.

The patient left hospital in eleven days, having made a good recovery.

Case v. E. B., was admitted October 25, 1934.

History. Patient's last menstrual period was November 9, 1934. She missed her regular period on December 9, 1934, but on December 15, 1934, began to have some dark spotting. She felt generally ill and had cramp like pains.

Physical Examination. Patient was very tender, and it was difficult to palpate any abnormalities of adnexa, but there was more tenderness on the right side. The diagnosis was based on her history. On December 26, 1935 she was operated, an unruptured right tubal pregnancy with some free blood in abdominal cavity being found. She made a good recovery.

Case vi. F. S., was admitted May 1, 1935.

This was her second admission; she was Case iv of our series admitted in October, 1934.

History. Patient was admitted to the hospital at 3:00 a.m. She gave a history of having her last menstrual period in March 5, 1935 and missed in April. Before her admission she began to have slight persistant bleeding, accompanied by slight pain in the lower abdomen. Three days previously she had some nausea and vomited. The pain and shock was similar to her previous attacks so she called her physician at once.

Operation. Left tubal pregnancy which had ruptured was found. The appendix was removed also.

The patient made a good recovery the second time.

Case vii. V. F. was admitted May 4, 1935.

History. This patient was admitted in severe shock with abdominal pain and secondary anemia. She was married for seven years and although desirous to have children never became pregnant. Five years ago had an attack of pain in both sides and elevation of temperature, which was suggestive of salpingitis. Her last menstrual period was on March 28. About three weeks later patient had some vaginal bleeding and slight pain in abdomen; she thought and hoped she was normally pregnant. About three days before admission she had had severe abdominal pain, relieved somewhat by sedatives.

On the morning of her admission patient had severe abdominal pain and fainted. She was taken to the hospital in severe shock. The foot of her bed elevated and intravenous was started at once. Donors were typed for blood transfusion, 1000 c.c. of glucose and normal saline given preoperatively.

Operation. Abdomen opened and left tubal pregnancy with a large amount of free blood in the abdomen was found. There was also evi-

dence of an old chronic salpingitis. Autotransfusion of 1000 c.c. blood was given.

The patient made a good recovery and went home in ten days. We believe that the old salpingitis was the causitive factor in this case.

Case VIII. C. W. was admitted May 30, 1935.

History. Patient first seen on April 30, 1935 when she had severe pain in the right side of her abdomen, but no shock. She had a similar attack of pain about one year ago and her physician told her she had chronic appendicitis. On our examination her temperature was normal; the pain was too severe for appendicitis and also she had had mild cramp like pains for the previous three weeks.

Pelvic examination showed chronic bilateral salpingitis.

Past History. She had had abdominal pain on both sides. The last menstrual period was during the first week of March and she was going to have an abortion done.

This case was diagnosed as probably an early ectopic pregnancy and suggested hospitalization and possibly be operated the next day. As the patient felt much improved the following day surgery was refused and she left the hospital.

Thirty days later she called her physician at three o'clock in the morning and he called me. We both felt sure she had ruptured ectopic pregnancy. When seen later at the hospital she was in severe shock and had marked evidence of anemia.

Operation. Intravenous was started on the operating table and she was operated very rapidly. A ruptured tube and free blood were found in the abdominal cavity. Because of the chronic infection of the tubes the blood in the abdominal cavity was not used for autotransfusion; 500 c.c. of glucose was given intravenously.

A few hours after operation a transfusion of 600 c.c. of whole blood was given. Patient made good recovery.

At our first visit the patient no doubt had an ectopic pregnancy, which ruptured at the time of her second admission. Salpingitis was probably the cause of the tubal pregnancy in this case.

Case IX. B. T. was admitted September 11, 1935.

History. Although patient had been married six years she had never become pregnant, but had never done anything to prevent pregnancy. Patient had intermittent abdominal pain. She missed her regular period of June 12, 1935, and in July, 1935, began to bleed; this was not a regular menstrual period for the bleeding was of a dark chocolate color. Her family physician thought she had an ectopic pregnancy.

Vaginal Findings. An enlarged uterus with a mass on the right side was palpated. Patient was sent to the hospital the next day.

Operation. The abdomen was opened and a right tubal pregnancy was found. The tube was removed. The left tube was completely sealed off from an old infection. Salpingitis was again the cause of an ectopic pregnancy.

This case was seen before rupture and made a good recovery. The patient left the hospital in ten days.

Case X. C. N. was admitted September 30, 1935.

History. The patient's chief complaints were abdominal cramps and bleeding. There was tenderness in both lower quadrants. Patient had had an appendectomy performed several years ago. Her last menstrual period was July 19, 1935 which was normal. She missed her August period and ten days later she began to flow irregularly, fairly large amount at times but dark in color. One week before admission patient had an attack of pain in the left lower quadrant. These attacks continued and were very severe. She was seen by her family physician who sent her to the hospital.

Vaginal Findings. Bilateral tenderness with apparent mass on each side was felt.

Operation revealed a left tubal pregnancy with beginning rupture and a right ovarian cyst with chronic salpingitis. Both tubes and the right cystic ovary were removed.

The patient made a good recovery.

Case XI. E. E. was admitted October 13, 1935.

History. Patient missed her last menstrual period in September 9, 1935. Ten days after her regular menstrual time in September she began to have spotted, intermittent bleeding. One week before her admission to the hospital she began to have cramp like pain in her abdomen and in October 12, 1935 she began to have more severe pain, worse than at any time since the onset of her illness. In the morning of her admission to the hospital she had excruciat-

ing pain, more marked in the left side, was in early shock and very anemic.

Vaginal examination revealed a somewhat large and tender uterus. Patient was tender throughout the entire pelvis but more marked on the left side, where a mass was present.

Operation. Intravenous glucose was given preoperatively. There were evidences of an old chronic bilateral salpingitis and a left unruptured tubal pregnancy about two inches in diameter. The ovaries were normal, there was a pint of free blood in abdominal cavity. The usual abdominal incision was made. The free blood in the abdominal cavity was removed by suction and the clots removed from pelvis. The left tube resected, after which the abdomen was closed.

The patient made an excellent recovery. It was unnecessary to give a blood transfusion. The patient left the hospital on the eighth day.

Case xii. A married woman of twenty-seven years, admitted with a history of irregular bleeding, was operated February 26, 1936.

History. Her last normal menstrual period was during the first week in December. She had persistent intermittent bleeding since the last week in December. At times this bleeding was profuse, at other times dark brown and scant. She was hospitalized by her family physician as a possible incomplete abortion.

Past History. An appendectomy and Baldy-Webster suspension of the uterus was done in 1928; positive Wassermann reaction four years ago which was treated and the blood rendered negative and seven months miscarriage in 1934.

Physical Examination. An enlarged uterus, a mass in the right pelvic region and bilateral tenderness were palpated. The abdomen simulated salpingitis. The temperature was 99°F.

The blood count showed 3,870,000 erythrocytes, hemoglobin 71 per cent and 9200 leucocytes.

Operation. No uterine contents were obtained by curettage. A needle puncture in the posterior cul-de-sac revealed blood. Under anesthesia the mass in the right pelvic region could be felt more definitely. On opening the abdomen through a midline incision the uterus was found to be increased to about the size of a two months pregnancy, and a right tubo-ovarian mass which included the placenta and disintegrated fetus. There were several adhesions between the omentum and the uterus from the former operation. There was 300 c.c. of free blood which was removed with sterile suction and returned with saline to the patient's vein by autotransfusion. The right pelvic mass which included the disintegrated pregnancy and ovary was removed en masse. The uterine area was well peritonized and the abdomen closed. The patient was transfused within twenty hours receiving 600 c.c. of blood. To date she is making an excellent recovery.

SUMMARY

1. The diagnosis and treatment of ectopic (tubal) pregnancy is reviewed.

2. Several causes of ectopic pregnancy are discussed.

3. The diagnosis of tubal pregnancy is considered (a) before rupture; (b) beginning rupture or abortion; (c) after rupture.

4. The physical findings of this condition are described.

5. The treatment is surgical, there is no other.

6. A brief review of 12 successive cases is given.

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DIAGNOSIS AND TREATMENT OF CANCER OF PELVIC COLON AND RECTUM*

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THE late Dr. John T. Hodgen advised his students to present their failures rather than their successfully treated cases, inasmuch as we are apt to acquire more knowledge from a contemplation of our deficiencies and disappointments. In the campaign against cancer the clinician is so frequently baffled in his attempts to cure that he needs the encouragement of at least a few cases which terminated favorably. In this paper we wish to present an analysis of a series of patients afflicted with cancer of the pelvic colon and rectum, a region of the body in which early diagnosis and effectual treatment presents exceptional anatomic difficulties.

The diagnosis depends largely on the systematic use of the proctosigmoidoscope. Since 1908 an inflexible rule in the clinic has been maintained that every patient coming for general examination must be subjected to proctosigmoidoscopy. The technique has been published elsewhere.[1] In 1916[2] attention was called to the frequency with which polypi of the rectum and sigmoid undergo malignant degeneration. In 1930 our results in the treatment of cancer of the rectum and pelvic colon by diathermy were presented[3] and emphasizing the dangers and limitations in the employment of radium in this region of the body. Since this paper was published a large number of early cancers and precancerous lesions have been treated by diathermy in the clinic and we wish to reiterate our stanch commendation of the method.

The classic history and symptoms of malignancy of the colon and rectum have been taught erroneously and disastrously. The early diagnosis depends on "cancer-consciousness." The early lesion produces no definite symptoms. A bizarre indigestion, a sensation of abdominal fullness, slight constipation or diarrhea, all may be the initial symptoms of pelvic colon cancer. Pain is absent in early lesion unless the anal canal is involved. Obstructive symptoms occur only in late and usually inoperable growths. *The history of the patient's observation of blood in the feces should always excite the suspicion of cancer.*

Diagnosis of growths occurring above the reach of the sigmoidoscope require the aid of the barium enema and roentgen ray. Because of the variability of the length of the pelvic loop, its mobility and tendency to overlap and obscure the outline of portions of the gut, extreme difficulty is experienced, particularly in non-obstructive lesions. The fluoroscopic technique is of great importance.

The barium enema should be given with the least discomfort to the patient, i.e., by gravity pressure rather than force. Instead of the old reservoir elevated high in the air and with a rubber bulb pump attachment, our barium enema equipment consists simply of a large glass funnel, rubber tubing, and a large caliber metal tip especially designed by Dr. R. Walter Mills. This gravity flow method permits regulation of the flow of the barium by raising and lowering the funnel, or to drain the barium solution from the lower colon if necessary. Filling defects of the pelvic colon are difficult to demonstrate due to spasms, position of the patient and lack of canalization. Usually the oblique position separates the pelvic loop. Correct position is obtained by rotating the patient under the fluoroscopic screen before roentgenograms are made. A series of films taken at different angles will usually localize the

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lesion. Skiabaryt, which consists of barium and a suspension medium, has proven very satisfactory. The formula which we have employed is a mixture of five ounces of Skiabaryt to each quart of water.

Fig. 1. Case 11. Note slight irregularity in loop of pelvic colon which proved to be the location of the growth. Observe how easily such defects can be obscured by over-lying loops of redundant pelvic colon. The constant finding of blood on an applicator through a sigmoidoscope materially aids the diagnosis.

Fig. 2. Showing normal canalization of colon after closure of colostomy. Since operation stools negative for occult blood (guaiac test). Barium enema check-up repeatedly negative. Patient well four and one-half years after resection.

The surgeon is confronted with the difficult problem of selecting the type of operation adapted to the exigencies of the individual case. Each patient must be considered on the basis of his general condition, his constitutional vitality and the particular local conditions about the lesion. The same general principles in treatment of carcinoma elsewhere in the body should apply in the lesions of the colon and

Table 1

Summary of Results in Surgical Management of Carcinoma of Rectum and Pelvic Colon

Site of Carcinoma	Total No. of Cases	Operable	Inoperable	Per Cent Operability	Hospital Deaths	Mortality Percentage	Cause of Death
Rectum	20	12	8	40	2	10	1 Peritonitis 1 Bronchopneumonia
Recto-sigmoid	15	10	5	66.6	1	6.6	Bronchopneumonia
Pelvic colon	18	9	9	50	1	5.5	Separation of wound, evisceration, peritonitis and pneumonia
Rectum with attachment to uterus	1	1	..	....	..	....	Died after 2½ years of recurrence in pelvis
Total cases	54	32	22	59.2	4	7.4	N. B. Cases classified as hospital deaths only if expired in less than 30 days. Reason, some of palliative cases wished to remain in hospital until exitus rather than return home, though able to do so.

rectum; namely, radical extirpation or destruction of the neoplasm. Accordingly, surgery is recommended for all except the

Fig. 3. Photograph of gross specimen, typical of early, slow growing adenocarcinoma of low degree of malignancy. Graded II by microscopic examination by Dr. Ralph Thompson.

very early and relatively benign adenomatous polypi some of which undergo malignant change very slowly and are readily destroyed by electrocoagulation through a proctoscope.

Growths situated at or below the peritoneal reflection of the rectosigmoid in the majority of instances, are suitable for a radical abdominoperineal type of operation, several modifications of which have been described by Miles,[4] Rankin,[5] Lahey,[6] Coffey,[7] Bartlett[8] and others. This operation can be done in one or two stages according to the local anatomic and pathologic changes or dependent on the patient's general condition. A modified Kraske or posterior resection as recommended by Sistrunk[9] can be applied to low lying growths of the ampulla recti or those situated in the anal canal or just above it. The author (J. W. T.) has most frequently employed this type of procedure as shown in the Table III. The double barrelled colostomy loop, however, is not as satisfactory as the single barrel type manufactured in the abdominoperineal procedure.

Fig. 4. Showing the case of large inoperable carcinoma of pelvic colon. Growth fixed to surrounding structures and pelvic wall. Note that the colon canalizes readily. This lesion too high for visualization through sigmoidoscope.

Operations designed to preserve the anal sphincters are ideal only in conception. Their practical application is limited to a very selected small group of cases as recommended by Vernon David[10] and Dixon.[11] By far the larger number of patients will be cured of cancer by close adherence to the classic surgical principles in treating cancer, radical removal of the growth and everything around or near it including the regional lymphatics wherever it is technically possible.

Growths higher in the rectosigmoid and pelvic colon can be readily managed by an abdominal approach. Here again individual practices and opinions vary considerably. The so-called obstructive type of resection based upon the Mikulicz-Paul principle is probably the safest and more generally applicable. Anatomic variations and the situation of the growths frequently influence the selection of operation. The end to end type of anastomosis in one stage can

be done safely in early cases to the patient's great advantage. A period of invalidism due to the temporary fecal fistula is avoided, convalescence is much shorter and hospital charges are reduced. Unfortunately such cases are seen rather seldom. The tables show that this was possible in only 5 instances. The Balfour-Morrison[12] tube resection method was used in 2 instances with excellent results in both.

A study of the accompanying tables will make clear the results obtained by the author, (J. W. T.) in a personal series of 54 operative cases of cancer of the rectum and pelvic colon. The good results and favorable mortality rates are undoubtedly due to the fact that the majority of these were diagnosed very early in the course of the disease. This statement is borne out in the low general operative mortality rate, 7.4 per cent.

The tables summarize briefly our experience in the surgical management and

Table II
SUMMARY GUIDE TO PROGNOSIS

	Resected Cases		Palliated Cases	
	Number	Per Cent Mortality	Number	Per cent
Operative deaths...	4	12.5	0	0
Died since operation	4	12.5	16	72.3
Alive 5 years or longer after operation...	12	37.5	0	0
Alive less than 5 years (more recent cases)	12	37.5	6	27.2
Totals.....	32		22	

Total number of patients operated..... 54
Total cases resectable..... 32
Palliative colostomy or exploratory only..... 22
Total hospital deaths..... 4
Combined operative mortality for series..... 7.4

N. B. No immediate operative mortality in palliative procedure or exploration. Several patients remained in or returned to hospitals until exitus.

Fig. 5. Large filling defect in pelvic colon. Note easy canalization. Metastasis present in liver. No operative procedure. Exitus several weeks following examination.

Table III
SUMMARY OF TYPE OF OPERATION EMPLOYED IN RESECTED CASES

Type of Operation	Number	Operative Deaths	Per Cent	Died Since	Per Cent	Remarks
One stage abdomino-perineal resection.....	4	0	0	1	25	Recurrence
Two stage abdomino-perineal.....	3	0	0	0		
Modified Kraske posterior resection.....	9	1	11	1	11	Recurrence
Obstructive resection.....	10	1	10	2	20	Metastases
Aseptic end to end.....	3	Bronchopneumonia	33.3			
Tube resection.....	2	0	0			
Harrison-Cripps.....	1	1	....	..	....	Died of sepsis (pelvic abscess)
Totals.....	32	4	12½	4	12½	

end results obtained. The importance of centralization of these cases and intelligent cooperation between clinician and surgeon cannot be overemphasized. Bargen,[13] among many others, has repeatedly extolled the virtue of adequate preoperative preparation of the bowel through decompression, even employing cecostomy in obstructed cases. A series of mineral oil retention enemas employed prior to operation have been of great value. Vaccination to stimulate the defensive properties of the peritoneum has apparently assisted in diminishing operative mortality.

CASE REPORTS

Demonstrating Curability of Cancer of Rectum and Pelvic Colon

Case I. Female, age forty-six years, entered the clinic May 8, 1929, with complaints of constipation and intestinal gas. For the past year she had observed blood droplets in the feces after saline purgation. Her general condition was excellent, there was no weight loss. *X*-ray films demonstrated the presence of diverticulosis of the descending and iliac colon. Sigmoidoscopy disclosed a polypoid walnut size growth on the anterior wall at the 8 inch line. It was irregularly nodular and bled easily. At operation was found a carcinomatous polyp, Grade 1, in the sigmoid. It was on a long pedicle but in removal this was excised down into the normal tissue. Resection of a segment of bowel was not done inasmuch as the malignancy was of low grade. The patient has been under observation since the operation, with sigmoidoscopy done at least once a year and she has remained in splendid health six and one-half years.

Case II. Female, age forty-four years, admitted March 23, 1931, in good general health with no weight loss. She has always been constipated and therefore a habitual cathartic taker. For past year she noticed blood in the feces which she attributed to hemorrhoids. Sigmoidoscopy revealed normal mucosa and strongly contracted rectosigmoid. She was given a course of oil enemas and a 10 inch view was finally secured. *A 12 inch cotton applicator always came back blood stained.* Barium enema revealed an indistinct irregularity in the outline of the pelvic colon for a distance of 3 inches. April 18, 1931, under spinal anesthesia, the abdomen was explored through a low left rectus incision. A cancer of the ileopelvic colon was found just above the rectosigmoid juncture. (See figures.) The remainder of the abdominal viscera and all peritoneal surfaces were carefully examined and no gross evidence of metastases or malignant peritoneal implantations were found. An obstructive type of resection was performed employing Rankin's clamp for the purpose. The patient made a good postoperative recovery. On July 29, 1931, the colostomy was closed, again using spinal anesthesia. Ultimate complete restoration of colonic function was obtained. She has been in good health four and one-half years after operation.

Case III. Male, age forty-seven years, was admitted September 21, 1925, in good general condition with no weight loss. He first saw blood in his feces one year ago. For the past six months constipation and frequent attacks of diarrhoea with passage of considerable mucous and blood has been present. Proctosigmoidoscopy revealed an adenocarcinoma at the 5 inch level, the size of a walnut with a broad base. At operation, October 5, 1925, colostomy was done and three weeks later 10 inches of the colon was resected and end to end anastomosis made. The pathologist reported carcinoma with glandular involvement. January 23, 1926, proctosigmoidoscopy revealed ten small polypi approximately at the site of suture, one was pedunculated and the others had broad bases varying in size from a pea to a hazelnut. Diathermy was used with final disappearance. Patient has been under observation since, remains well and has had no recurrence in ten years.

Case IV. Female, age fifty-two years, was admitted March 13, 1917. He had been under treatment for diabetes and constipation. Six small adenomatous polyps were removed by guillotine from the rectum at the 4 inch level. In 1927, she returned with a history of rectal bleeding. An adenocarcinoma which was confirmed by biopsy, was located 3 inches above sphincter. It was irregularly nodular, 2×3 inches projecting an inch above the mucosa. It was destroyed by diathermy by intermittent sparkings lasting six weeks. Patient has been under observation since, remains well and has had no recurrence in eight years.

Case v. Male, age fifty-four years, was admitted November 1918 giving a history of loss of twenty-five pounds in weight, pain and tenesmus. Proctosigmoidoscopy revealed a large adenocarcinoma which almost fills the entire ampulla. Operation December 14, 1918, by Dr. H. G. Mudd, who did a Kraske and a permanent colostomy. In October, 1919, there was a large nodular recurrence of growth about anal scar. Dr. J. S. Kimbrough introduced a tube containing 75 mg. of radium leaving it in for twelve hours. A large slough followed with final healing. The patient has been under observation since with no recurrence after sixteen years.

DISCUSSION

Great progress has been made in the last decade in the diagnosis and surgical management of carcinoma of the large bowel. In spite of these advances too many patients with malignant disease consult the surgeon when the lesion has become inoperable. The curability of cancer of the rectum and pelvic colon has been repeatedly demonstrated. Even a 25 per cent chance of "five year cure" is a better expectancy than usually obtained in cancer of the cervix. The premalignant polypoid lesions of the rectum are just as amenable to treatment by surgical diathermy as the premalignant lesion of the cervix. It has been shown that the mortality and morbidity in the radical surgical treatment of cancer of the rectum in experienced hands is no greater than that admittedly justified in surgical procedures for cancer of the uterus. Despite these facts many physicians are reluctant to advise colostomy and radical removal of malignant lesions of the rectum and lower colon. The profession must be made "cancer-conscious," to be continually alert to the possibility and probability of cancer existing in apparently healthy individuals who suffer from seemingly minor symptoms. While this series of cases is comparatively small, the fact that 37 per cent are alive and well five years or more after resection lends distinct encouragement in prognosis. Eternal vigilance is the price of success in curing cancer of the rectum and pelvic colon.

SUMMARY

1. Routine proctosigmoidoscopy is recommended as part of every complete physical examination.

2. The necessity of careful, skillful fluoroscopic examination of the pelvic colon is emphasized in the early diagnosis of malignant lesions.

3. A series of surgically treated cases of cancer of the rectum and pelvic colon is presented with tables showing end results.

4. Individual case reports demonstrating the curability of cancer are recorded.

5. The value of surgical diathermy in the management of precancerous and cancerous lesions of the rectum and pelvic colon is emphasized.

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REPAIR OF CERTAIN TYPE OF HERNIA

HERNIAL SAC USED AS SUTURE MATERIAL

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FOR years surgeons have attacked the problem of the cure of inguinal hernia. This was first done by obliteration of the sac with cautery or carbolic acid, in the belief that this was the only necessary procedure to effect a cure. Then, removal of the sac was advocated. Later, it was ascertained that the repair of the floor of the inguinal canal was essential. Today these procedures form the basis of the Bassini operation. Astley Cooper[1] in his treatise on hernia in 1804, described hernia in a light that was to be acceptable to later work. In searching through the literature I have found only one reference to the use of hernial sac in the manner which is here described. In 1930 Brown[3] first described a method similar to the one used in this paper.

In a city hospital with a large and active surgical service a type of hernia is frequently found in which the ordinary repair will be ineffective. This hernia usually requires a fascia lata repair by the Gallie method[2] or some modification of it. Accompanying this type of hernia there is usually a large external opening and a marked weakening of the inguinal floor. In several of these cases a very large and markedly thickened sac extended into the scrotum. The application of this particular kind of hernial sac as suture material in the manner of a fascia lata repair has been studied. Studies of the microscopic sections of these hernial sacs convinced us that there were enough muscle fibers and elastic fibers and no round cell infiltration to make this material suitable for suture. (Figs. 1 and 2.) Estimations of its tensile strength compared favorably with commercial ox fascia. In this comparison fresh hernial sac tissue without any hardening or preservative was used.

INDICATIONS

The one requirement for this procedure is that the hernial sac must be of sufficient thickness and size to give length and strength to the suture material. The minimum thickness of the sac used in these cases was 3 mm. It must be accentuated that a sac which is too thin will not produce a good result. Therefore, this repair is indicated when a large hernia is found that presents a sac of sufficient thickness and size, together with a marked weakness on the floor of the inguinal canal.

TECHNIQUE

The usual inguinal incision is made through the skin, subcutaneous tissue and the fascia of the external oblique muscle, exposing the cremaster muscle and the spermatic cord. The hernial sac is then dissected from below upward and resected at the internal inguinal ring. The stump of the hernial sac is ligated with a suture ligature of No. 2 chromic catgut and tied. The stump is transplanted under the internal oblique muscle with one interrupted No. 2 chromic catgut suture. (Fig. 3.) The sac which has previously been amputated is now cut circularly from the top to the bottom, giving a strip of suture material ⅜ of an inch wide, as shown in Figure 4-1. This strip of fascia like material is then threaded into a thin fascia needle and is interlaced between the internal oblique muscle and Poupart's ligament, as close as possible to the pubic bone in the conjoined tendon. (Fig. 5.) As this interlacing is being done, a No. 2 chromic catgut

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suture is placed at every crossing of the suture material to prevent any slipping. The ends of the suture material are then brought out through the fascia of the external oblique muscle and sutured with an interrupted suture of No. 2 chromic is closed by using a No. 2 chromic catgut interrupted suture for the fascia of the external oblique muscle. (Fig. 5.) The skin catgut. This interlacing and the internal oblique muscle forms a floor in the inguinal canal. The cord is replaced and the wound is united in the usual manner. A small piece of rubber tissue drain is then inserted in the lower angle of the wound where it remains for forty-eight hours.

When the hernial sac is to be used as suture material and also as a graft over the interlacing sutures, the sac is bisected from its bottom upward to the internal inguinal ring, leaving the posterior half attached to the ligated stump. The anterior half is then used as suture material. The method of cutting is shown in Figure 4 *a* and *b*.

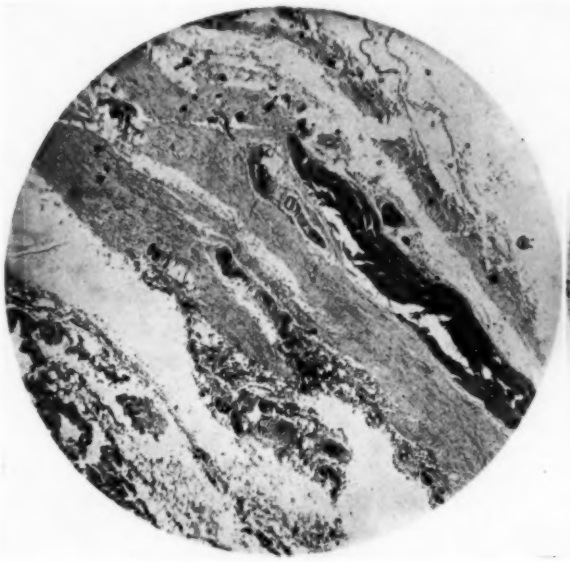

Fig. 1.

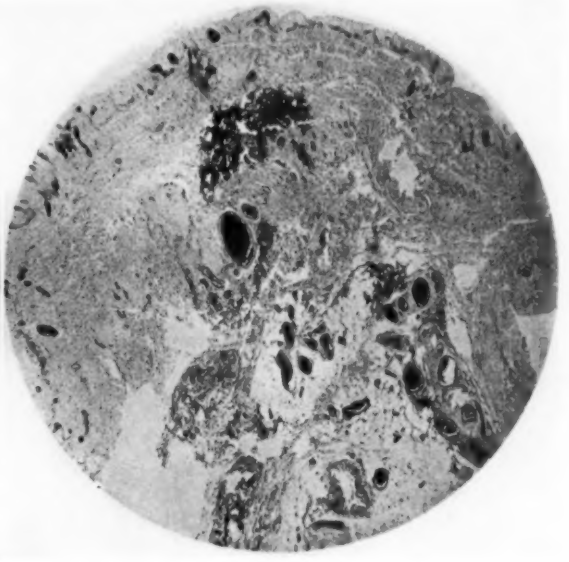

Fig. 2.

Microscopic cross section of hernial sac showing muscle fibres, blood vessels, connective tissue fibres but no round cell infiltration.

REPORT OF CASES

This procedure has been followed in 13 cases with complete success in 12 and partial success in one, two or more years postoperative. All were males and there were no deaths. In the one case of partial recurrence, it was thought that the error was made in not placing the suture close enough to the pubic bone. There were two superficial infections, both Staphylococcus albus in origin.

Fig. 3. Sac dissected upward and resected stump is transfixed.

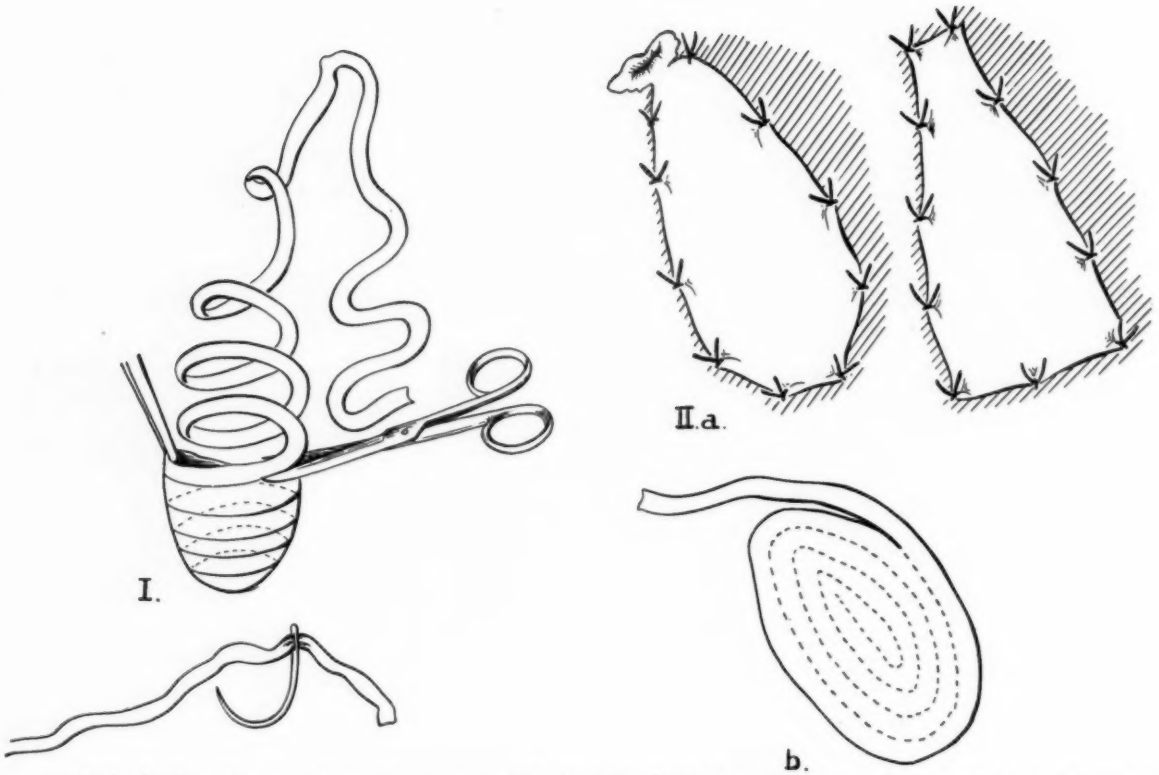

FIG. 4. Method of cutting sac into suture material. Also method of transplant with posterior attachment to stump and without attachment to stump.

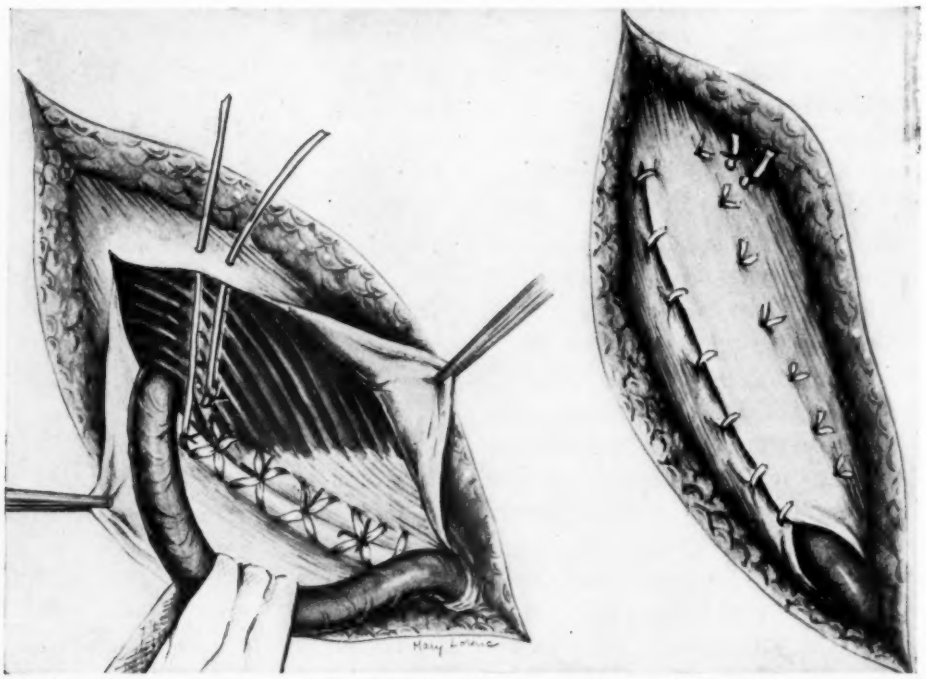

FIG. 5. Method of interlacing suture material and placing tie sutures. Also method of closing external oblique fascia.

COMMENT

It must be borne in mind that the hernial sac which is to be used as suture material must be of the required thickness. Experience has taught that if the sac is too thin for use in this manner there will be a recurrence. It is believed that in the occasional case of this type when this described procedure is indicated it will be essentially successful, and it is easier and quicker to perform than the usual fascia lata transplant. Not all hernias which appear clinically to be the type for this manipulation will prove at operation to have a sac of sufficient thickness. The only means of determining a case that is applicable for the foregoing procedure is by a thorough examination of the sac at the time of the repair.

SUMMARY

A method for the repair of a certain type of inguinal hernia using the hernial sac as suture material has been described. There were 12 cases completely successful and one partially successful.

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[For remainder of references see p. 107.]

* *Continued from p. 62.*

EPISIOTOMY UNDER LOCAL ANESTHESIA

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A PROCEDURE that lessens the danger or difficulty of childbirth and at the same time tends to lower the cost of medical care is worthy of serious consideration. The majority of labors, at home or at the hospital are attended by a single physician and a method that makes labor more efficient is bound to improve obstetric morbidity and mortality statistics.

The desirability of episiotomy is well known. The child's welfare is improved and the mother's strength is preserved by this operation whenever a rigid or disproportionate perineum is encountered. A clean cut wound is more easily and effectively repaired than a tear. The use of barbiturates sometimes makes voluntary efforts difficult or too feeble to be effective in getting the head over a resistant perineum. Episiotomy with low forceps then would be indicated. The increasing use of barbiturates in obstetrics will probably make such instances more frequent. With a single physician in attendance, the difficulty of obtaining a desirable anesthesia would cause withholding from doing an episiotomy where indicated. Where "prophylactic" forceps with episiotomy is practiced, barbital narcosis with local anesthesia might be sufficient for the procedure and thus the patient avoids the disadvantages of general anesthesia. Where chloroform or ether is used for such work the toxicity and postanesthetic discomfort are decidedly detrimental. Delay of postpartum contraction and retraction of the uterus caused by general anesthesia with consequent danger of hemorrhage is obviated by the use of local anesthesia.

Technique. The mediolateral incision is used. Using a hypodermic needle, and 1 per cent procaine, a bleb is raised in the skin at the edge of the vulva near the fourchette, preferably at the time the fetal head causes bulging of the perineum. A 20 gauge 2 inch needle is then placed on the syringe and the needle directed laterally and downward, injecting as it is advanced and drawn back to the skin. The needle is again advanced along the vaginal wall, with a finger in the vagina to guide the needle and prevent piercing the vaginal mucosa. Incision is made by a series of scissor cuts so as to judge accurately the depth of incision along the skin and the mucosa. Bleeding is controlled by clamp and ligature. The fetal head is delivered by encouraging voluntary efforts during a pain, Kristeller expression or the use of low forceps. A Beck binder to make voluntary efforts more efficient is of advantage.

While awaiting separation of the placenta, the sutures are placed using No. 2 chromic catgut. After the delivery of the placenta the sutures are tied and silkworm gut is used to approximate the skin. The silkworm sutures are placed deeply and then tied without tension.

No deformity of the perineum after healing was noted when the mediolateral incision was used. It is superior to median episiotomy as the anal sphincter is not needlessly exposed to damage.

Comment. The use of local anesthesia for episiotomy is advised and described. It increases safety and decreases expense of accouchement. By removing the obstacles of anesthesia the application of episiotomy is simplified for the general practitioner delivering a mother in the home. An easier application of a valuable procedure and a consequent wider practice of perineal suture should improve the practice of obstetrics.

PERITONEAL SUTURES IN NARATH AND SCHÖNBAUER'S MODIFICATION OF TALMA'S OPERATION

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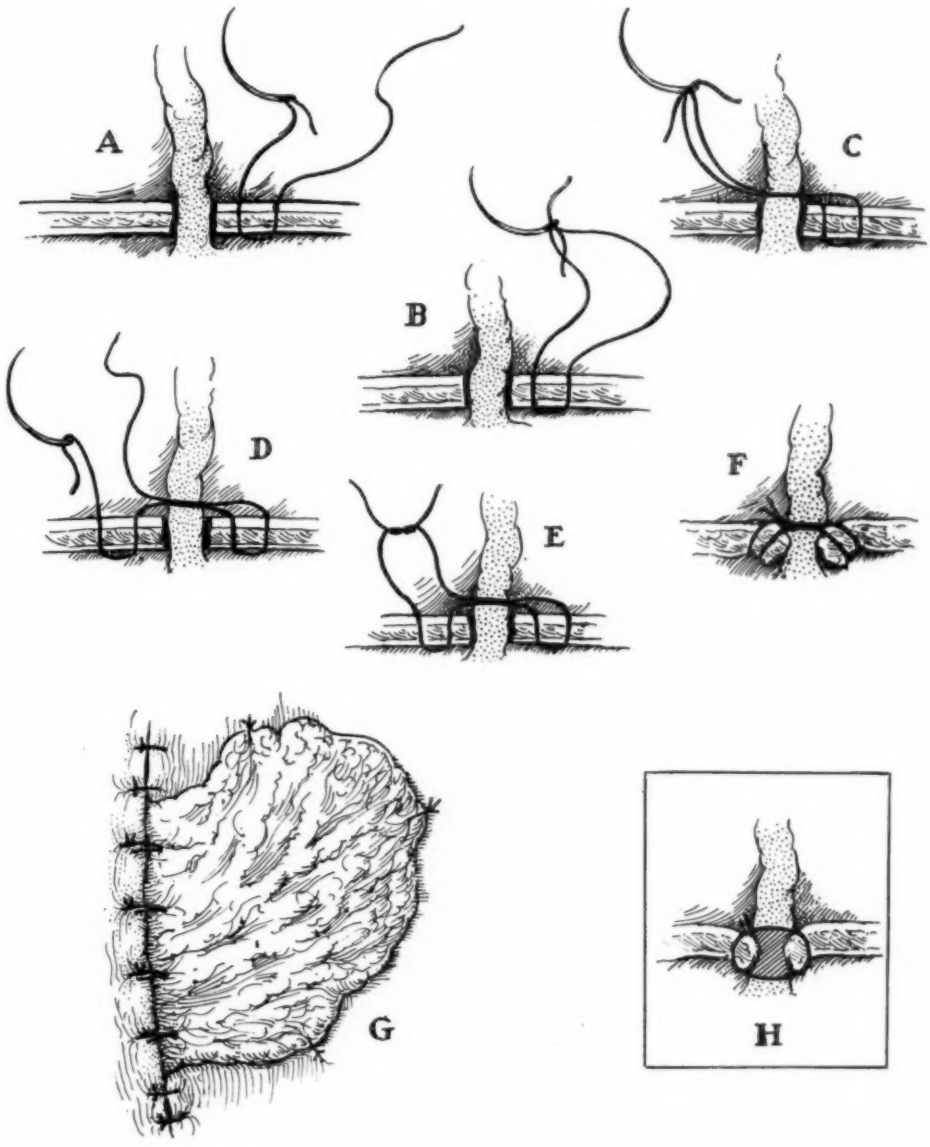
THE critical point in Narath and Schönbauer's modification of Talma's operation is the complete closure of the peritoneum in spite of the permanent protrusion of a part of the mesentery, its new location becoming the space between the posterior wall of the rectus sheath and the rectus muscle, or between the rectus sheath and the subcutaneous tissue. The purpose of this permanent eventration of the lower end of the mesentery and its fixation in a new position is the formation



of adhesions and subsequently the gradual establishment of a collateral circulation; portal vein, gastric or gastrio-epiploic veins, omental veins, the superior epigastric vein to the internal mammary and the subclavian vein or superficial epigastric vein to the femoral vein. This relieves the stasis in the portal system and prevents the accumulation of new ascitic fluid in the peritoneal cavity caused by cirrhosis of the liver. The peritoneum is closed by the usual method first above and then below the extent of the omentum (two upper and two lower sutures in Fig. G). The omentum, in passing through the peritoneal incision, is then spread out so that it lies as a flat sheet in the peritoneal slit and not as a crowded mass, which would prevent a close adaptation of the peritoneal margins. The sutures uniting the margins of the peritoneal wound in the line of the omental protrusion have to go through the omentum, which can be accomplished by different methods. If the suture is guided through one margin of the peritoneum, then through the protruding omentum, and finally through the other peritoneal margin, the ligature must be tightened around the mesentery as far as it protrudes. This represents a very crude method disturbing the circulation of the explanted part of the mesentery and should not be recommended, since the preservation of the circulation in the omentum must be the main purpose of the entire procedure. A better way would be the double threading through the omentum at two different points as shown in Fig. H, but this obviously endangers the viability of the piece of omentum encompassed by the suture and often causes its sloughing, and secondarily a gap in the peritoneum which is to be prevented because of the danger of herniation. Furthermore, if a necrosis should develop, there is also the danger of thrombosis of some vessels of the mesentery passing through the incision. Since the successful result of the operation depends upon the preservation of the circulation in the mesentery, this complication means a partial or total failure of the procedure.

Therefore, as a prophylactic measure, the following method is recommended. A mattress suture is applied through one margin of the peritoneum, and the posterior wall of the rectus sheath, as indicated in Fig. A. The free end is threaded again through the needle as illustrated in Fig. B, and the needle is carried through the omentum (Fig. C). Since both ends are threaded through the needle they both go through a common channel in the omentum. The longer end is again taken from the needle eye, and the next mattress suture is made with the single thread lateral to the other margin of the peritoneal wound, (Fig. D). The needle is then taken off, and both ends of the thread are ready for ligation (Figs. E and F). As both ends go through the same channel, the ligature can be made as tight as necessary without any danger of disturbing the circulation of the omentum (Figs. F and G), thus insuring the close adaptation of the sutured structures without danger of necrosis, as explained by the comparison of Figs. F and H.

PODALIC VERSION

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PODALIC version is one of the most important and efficient procedures in obstetrics, saving the parturient many hours of labor, and from lacerations and complications consequent on the application of forceps. In cases of justo minor pelvis, the obstetrician frequently obviates the necessity for cesarean section by a podalic version. Despite its inestimable value and the skill which many have acquired in performing it, I believe that the procedure has very definite indications and limitations.

Potter popularized and rejuvenated this ancient procedure, reporting on a large series and incorporated the good points of many other techniques with his own.

The following tables show the parity, indications, mortality and complications in a series of 120 consecutive cases of podalic version.

TABLE I

Para 0	Para 1	Para 2	Para 3	Para 4	Para 7
81	20	14	3	1	1

TABLE II

INDICATIONS

Contracted pelvis	63
Large baby	22
Head unengaged	8
Twins (usually the second baby)	10
R.O.P.	21
L.O.P.	7
R.M.P.	1
Transverse	3
Prolapsed cord	5
Maternal fatigue	3
Forceps unsuccessful prior to version	21

In many cases a few of the indications were simultaneously present.

TABLE III

Maternal mortality	0
Gross fetal mortality	11

Two of the fetal deaths occurred before the onset of labor; one was due to hydrocephalus, and the other was a macerated fetus, the cause of whose death was undetermined. Five infants died during labor before delivery. Three died either in the process of delivery or within a short time thereafter. The resumé of these three cases is as follows:

CASE I. This occured in a nullipara with a contracted pelvis. The baby was fairly large and the umbilical cord short. The cord tore before the shoulders could be delivered, though this was accomplished after only a short delay. The head was easily delivered. The baby lived about a half-hour and death was probably due to asphyxia. Autopsy was unobtainable. This woman was subsequently delivered of a living baby by cesarean section.

CASE II. This occured in a para seven with a contracted pelvis. The cord was prolapsed. The baby weighed over nine pounds. She had had similar experiences in some of her previous labors.

CASE III. This occured in a para three. The cord was prolapsed, the baby large, and the arms extended.

One fetal death occurred one week after delivery. Autopsy revealed massive hemorrhage into the adrenals, and hemorrhages from the mouth and the intestines. The pathologist, Dr. Joseph C. Ehrlich, considered this a case of adrenal apoplexy.

The gross fetal mortality in this series was 9.1 per cent; after deducting the deaths that occurred before delivery it was 3.3 per cent. The case of adrenal apoplexy was not deducted from the gross mortality because the etiology of this condition is still in doubt. Some pediatricians consider the cause to be trauma while others believe it to be infection. This child had fever and would tend to bolster the infectious theory of this disease. The mother of this child was subsequently delivered per vaginam of a normal baby.

TABLE IV

COMPLICATIONS

Maternal: Third degree tears	3
These were immediately repaired and all three women made perfect and uneventful recoveries.	
Fetal:—Fracture of humerus	1
Fracture of clavicle	1
Fracture of tibia	1
Erb's palsy	1
The fractures occurred in babies weighing between 8½ and 9½ pounds; all recovered. After prolonged orthopedic treatment the case of Erb's palsy now has satisfactory muscular development and function.	

DISCUSSION

Potter's technique is followed closely.

Though a lateral episiotomy is performed in most of the cases, especially in nullipara, the perineum is "ironed out" as this stretches and softens the tissues so that subsequent manipulations are facilitated.

Both shoulders are delivered anteriorly, no difficulty being encountered in the majority of cases. Occasionally when the anterior shoulder will not engage beneath the symphysis, it is preferable to rotate the child and permit the opposite shoulder to engage and deliver it anteriorly. In a few instances it was found necessary or easier to deliver one shoulder posteriorly.

Recently I have resorted to applying forceps to the aftercoming head, thereby saving several babies. The forceps traction is not as injurious to the fetal spine as is the traumatizing pull on the head that is "stuck."

In the cases of twins I find it expedient to deliver the second child by podalic version immediately after the birth of the first. Where intervention is necessary, the first child is usually delivered by forceps. In a few instances both children have been delivered by version. I do not advocate routine version delivery of both children because there is rarely sufficient space for the first fetus to make the elliptical excursion necessary in version. This lack of space frequently results in trauma and death to the first child.

Since many versions are performed because of disproportion, the greatest measure of success will come to the obstetrician who can choose the proper case for a version. I never attempt to perform a version where the disproportion is great, but I have delivered babies weighing more than ten pounds by this method. Patients with absolute disproportion I deliver by caeserean section.

In cases where pelvic delivery is possible and version may fail, I prefer to try to deliver first by forceps, for if forceps fail version can still be done.

In many cases of posterior or transverse occipital presentations I prefer version to the usual double maneuver necessary when forceps are applied.

SUMMARY

One hundred twenty babies were delivered by podalic version, employing the Potter technique. There was a real indication for version in every case.

There was a corrected mortality of 3.3 per cent and had one case of adrenal apoplexy also been deducted, which probably would have been justifiable, the mortality percentage would have been 2.5 per cent, not much higher than in a series of normal deliveries.

CONCLUSION

Given fine obstetrical judgment, podalic version is an ideal method of procedure for the lesser degrees and in some cases even of moderate degrees of pelvic contractions or disproportions. It is also of great value in malposition such as posterior occiput, transverse and face positions.

The Potter technique is the preferred method to employ in the performance of version.

In cases where difficulty is experienced in the delivery of the aftercoming head, forceps should be applied more often.

CASE REPORTS

FATALITIES IN PHRENIC NERVE SURGERY

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IN their recent publications on surgical diseases of the chest, Graham, Singer and Ballow have shown that this operative procedure is not entirely free from serious consequences. Berry in 1930 summarized 4697 cases of reported phrenic nerve operations in pulmonary tuberculosis found the mortality rate in this group was 0.5 per cent.

Since starting this work in 1930, we have done 150 cases of phrenic nerve operations, two-thirds had the nerve avulsed and one-third a crushing procedure producing a temporary hemi-diaphragmatic paralysis; 100 patients were operated for pulmonary tuberculosis and the remaining 50 for other forms of chronic pulmonary pathology.

If we group our cases we have a mortality rate of 0 in the tuberculous group, but in the non-tuberculous group it is 4 per cent. These fatalities are reviewed.

CASE 1. Patient, A. G., age thirty-two, was admitted to the medical service on January 28, 1934.

His father and mother had died of pneumonia.

The patient gave a history of chronic bronchitis since seven years of age and had had pneumonia five times. For the past fourteen years he had had a severe cough with pain in the chest, dyspnea on exertion, and has been raising an abundance of greenish yellow foul smelling sputum. Patient has been unable to work for several years.

The expansion of the chest was limited, but equal on both sides. Impaired resonance and moist rales were heard over upper half of both chests posteriorly, with medium crepitant rales over the upper third of left chest anteriorly. Loud moist rales were heard over both chests anteriorly.

Bilateral bronchiectasis was diagnosed, with tuberculosis to be ruled out. Repeated sputum examinations were negative for tuberculosis.

On bronchoscopy February 15, 1934 one ounce of mucopus was aspirated from right and left lower lobes.

March 2, 1934—Lipiodal *x*-ray showed evidence of marked bronchiectasis in the right and left cardio phrenic angles, more pronounced in the right side. The bronchiectases are of the saccular and cylindrical types, i.e., of the saccular type on the right side and of the cylindrical type on the left side.

The blood Wassermann was negative, the other laboratory findings were normal.

On March 8, 1934 under local anesthetic, the phrenic nerve on the left side was identified as it crossed the left anterior scalene muscle. It was frozen for about one minute with ethyl chloride. No further procedure was done.

The patient's condition was fair for the first few hours following operation. The foot of the bed was elevated slightly. The respirations were somewhat labored and atropine gr. $\frac{1}{150}$ was given by hypodermic.

March 9, 1934 the patient's condition became critical about 1:00 A.M. His respirations were embarrassed and very edematous; atropine and caffein were given to him. The blocks taken from the foot of the bed, and the patient put in Fowler's position. At 2:00 A.M. his condition was somewhat improved; he slept until 3:30 A.M., when he became much worse, respirations embarrassed, very edematous, unable to cough and raise sputum. He improved somewhat in an oxygen tent. At 4:30 A.M. his con-

dition became worse again. Moist mucous rales were heard throughout both lungs. The patient was unable to raise mucous.

One hour later the patient was moribund. Caffein and atropine were given to him. There was marked edema of both lungs. The patient was unable to raise any sputum, practically drowning in his own mucous. Fifteen minutes later he expired in spite of oxygen therapy and all forms of stimulation.

We have definitely learned that a phrenic operation in severe or moderately severe bronchiectases with unilateral or bilateral involvement is definitely harmful, as in our opinion, this case illustrates.

In his original report of phrenic paralysis Sauerbrack gave bronchiectasis as a condition helped by this operation, but no mention is made of the extent or degree of the bronchiectasis. It is possible that in mild forms this operation may be helpful.

Case II. T. M., white, male, forty years of age, was admitted March 11, 1935 to the Medical Service complaining of persistent cough and large amounts of foul-smelling sputum of six months duration; dyspnea on moderate exertion and loss of fifteen to twenty pounds in past two months.

Past History. Toe amputated several years ago. G.C. and chancre. Admitted in 1917.

Examination shows evidence of recent loss of weight. Showers of fine rales were heard throughout both apices. Percussion in these areas produced flatness. Sputum on several occasions was negative for tuberculosis.

The blood Wassermann was negative.

X-ray of the chest was negative for tuberculosis, but showed an area of increased transparency in right lower lung field due either to an unresolved pneumonic process or a lung abscess.

Two weeks later there was a localized area of destruction in right lower lung field suggestive of a lung abscess.

On March 22, 1935 the lung abscess was located by *x*-ray and fluoroscope in region of the fifth and sixth ribs anteriorly and seventh and eighth posteriorly.

April 5, 1935. Lung fixation was done under cyclo-propane anesthesia. Two strips of iodoform gauze were packed under the seventh and eighth ribs posteriorly and anteriorly under fifth and sixth ribs and patient returned to ward in fair condition.

Patient did fairly well for next few days though the respirations were somewhat labored.

One pack was removed on the fourth postoperative day.

On the sixth day the sutures and the remaining pack were removed. The general condition was good and the sputum was less in amount.

One week after the lung fixation, the right phrenic nerve was crushed for 0.5 cm. and patient returned to the ward in good condition.

The following day the condition was only fair; he was very dyspnoeic and perspiring profusely. He gave a history of an old asthmatic condition.

April 14, 1935. He was weak and dyspnoeic. Rales were heard in the chest characteristic of asthma. Long, loud expiratory grunts and wheezings were heard all over the back and lungs. Atropine and adrenaline was given to the patient and he was kept on continuous oxygen with little relief. Patient was unable to raise any mucous though there was marked edema of the lungs. Respirations were noisy. Patient had difficulty in breathing.

April 16, 1935. Condition was much worse; patient is dyspnoeic and somewhat cyanotic. Respirations were embarrassed and crackling rales were heard throughout the chest. Patient was unable to raise mucous except with great effort.

April 16, 1935. 12:40 P.M. The patient expired in spite of all forms of stimulation and continuous oxygen therapy.

In our opinion, these 2 deaths in this non-tuberculous group are attributable to various causes, namely:

(1) A lack of specific data as to the end results in this group composed of lung abscesses, bronchiectases and chronic empyema (non-tuberculous);

(2) The wide divergence of opinion as to the value of phrenic operations in those with chronic non-tuberculous forms of pulmonary pathology and

(3) The great variation in the nature and extent of the pathology.

If we use this as a workable plan, the case of severe bilateral bronchiectasis must definitely be accepted as inoperable, with

our present surgical knowledge. Early mild cases might occasionally be helped.

One of us, (E. G.), felt that some partial relief could be obtained by phrenic nerve operation.

Overholt in 1932 reported beneficial results obtained by fixation of the lung at a point just above the upper limit of the abscess, followed by a temporary hemidiaphragmatic paralysis. This procedure was followed in Case 11. The first stage was not associated with reaction but eighteen hours after the phrenic operation dyspnea started and continued until his death. This breathing was typically asthmatic, but no treatment was beneficial. I feel that the operative procedure was responsible for precipitating this pulmonary calamity.

In reviewing our operative mortality in this series of 150 phrenic nerve operations, it will be noted that in the cases of pulmonary tuberculosis there were no deaths. It is in this group that this operation unquestionably does its greatest good. With any method producing such excellent results as it does in pulmonary tuberculosis, it is only logical that we pass through a developmental stage of chest surgery, trying to incorporate this procedure with other therapeutic means in non-tuberculous chest problems.

In the division of Thoracic Surgery at Kings County Hospital from which these deaths are reported, our experiences have shown that in the non-tuberculous group this surgical procedure has been discouraging except in an exceedingly small, selected group.

SUMMARY

After we had completed the reported series of phrenic nerve operations we were impressed with the exceptionally brilliant results that often followed the procedure in effecting cures in many protracted cases of pulmonary tuberculosis, in some cases thoracoplasty has been made unnecessary and in others extensive thoracoplasty has been definitely limited to the upper stages. In our experience there was ample data to prove the value of this operation in pulmonary tuberculosis.

The most instructive aspect of this study from a comparative point of view was the small number of non-tuberculous patients that were definitely helped by this operation. In our opinion we feel that unless a very critical attitude is assumed concerning the marked limitation of the operation in this later group, serious complications can readily develop.

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* *Continued from p. 99.*

PARTIAL GIGANTISM: OVERGROWTH AND ASYMMETRY OF BONES AND SKELETAL MUSCLE

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A SIX year old boy was admitted to the Orthopedic Service of the University of Illinois, College of Medicine, presenting a very unusual condition: overgrowth of the legs especially of the feet and toes, the left leg larger than the right; asymmetry of the head; a large hemangioma of the chest wall and another one in the left groin. Cases of congenital partial gigantism are not a frequent orthopedic observation and always create speculation as to the etiologic factor or factors related to the overgrowth of bone and soft parts. In reviewing the literature, involvement of both feet was noted in only one other case, a twelve year old girl, reported by Spreitzer. In both cases several operations were performed to bring the feet nearer to normal size to facilitate walking and make it possible to wear shoes so that the patient could associate with other children.

CASE RFPORT

B. H., male, aged six, admitted, July 7, 1932.

Family History: The patient was the fourth in a family of six children; all the others appearing normal and healthy. Two preceding generations both paternal and maternal, revealed no history of deformity, tumor, nervous disease, or syphilis.

Personal History: The child was born at term after a laborious and prolonged delivery due to the presence of a large tumor in the left axilla. At birth a large tumor was found on the left thoracic wall near the axilla, a smaller one in the left groin, a considerably enlarged left foot with the second and third toes and the great and second toes on the right. As the boy grew the hypertrophy of the foot and the toes increased proportionately, rendering shoe wearing impossible. He never complained of pain, but was very awkward in walking, and hence avoided playing with other children.

Physical Examination: The patient was a poorly nourished, white boy who walked with a peculiar gait on account of the abnormity of the feet.

Head: The right side was notably larger than the left. The head measured 49 cm.; the right half 25.5 cm. and the left half 23.5 cm., from the glabella to the occiput. The right ear was 3 cm. more anterior than the left. *Eyes:* There was a convergent strabismus on the right, associated with far sightedness and astigmatism. *Eye grounds* were negative. *Nose and Ears* do not show any pathology. *Mouth* presented many carious deciduous teeth. *Throat and Thyroid Gland* were normal.

Chest: An extra thoracic soft tumerous mass measuring 14 × 26 × 5 cm. was situated on the left side.* Otherwise examination apparently negative.

Abdomen: Veins were very prominent. A soft tumor in the left groin measured 10 × 5 cm.

Upper Extremities presented no appreciable anomaly. The right forearm and arm were 0.5 cm. larger than the left.

Lower Extremities: The left limb was larger than the right, although both showed overdevelopment of the muscles. The circumference of the left thigh was 28 cm., and the right 25.5 cm.; the left calf 22.5 cm. and the right 17.5 cm. *Left Foot:* The length of the sole, from the heel to the tip of the great toe, 22.5 cm. on the left, and 20 cm. on the right. The anterior portion of the left foot was 7 cm. long and 6.25 cm. wide; of the right foot, 5.5 cm. long and 5 cm. wide.

Evidently the hypertrophy of the toes involved both the length and the width of the bones, most striking in the metatarsal and phalangeal epiphyses. The deformed toes showed the average range of motion except the

* A detailed description of the two tumors, found to be hemolymphangiomas and the treatment by surgery and radiation is not within the scope of this article and was the subject of another publication. AM. JOUR. SURG. 31: 354, Feb. 1936.

Left Toes:
The great toe —3.25 × 2 cms.; circumference —5.75 cm.
The second toe—6.5 × 3.25 cms.; circumference—9 cm.
The third toe —5.75 × 3 cms.; circumference —8.5 cm.
The fourth toe —3 × 1.33 cms.; circumference —3.5 cm.
The fifth toe —3 × 1.33 cms.; circumference —4 cm.
Right Toes:
The great toe —5 × 3.25 cms.; circumference —9 cm.
The second toe—4.5 × 2.5 cms.; circumference —7 cm.
The third toe —3 × 1.33 cms.; circumference —4 cm.
The fourth toe —3 × 1.1 cms.; circumference —3.5 cm
The fifth toe —3 × 1 cms.; circumference —3.5 cm.

plantar flexion of the last phalanges, which were held in slight hyperextension due to excessive growth of the articular ends. Adipose masses were present on the plantar surface of both feet, the left extended from the bases of the second and third metatarsals covering these two bones and the adjacent toes; on the right it covered about two-thirds of the first and a half of the second metatarsal bones, the great, the second and the third toes. There seemed to be thinning of the overlying skin which was white, cool and slightly shiny. Nails of the hypertrophied toes were normal, and they did not grow faster than the others.

Genitalia: There were dilated and tortuous veins in the scrotum.

The right testicle, in the scrotum, was of normal size and consistency.

The left undescended testicle appeared to contain cysts filled with a clear fluid.

Reflexes were normal.

Sensibility of the hypertrophied parts: tactile, temperature, pain and pressure was normal.

Blood and urine examinations showed no pathology.

Kahn test was negative.

X-ray films revealed developmental anomaly of structure of the involved metatarsals and phalanges, especially their epiphyses, in length and thickness.

The patient was slightly below average intelligence with quotient of approximately 83.

OPERATIVE PROCEDURES USED FOR CORRECTION OF FOOT AND TOES DEFORMITY

Disarticulation of the right second toe at the base of the second phalanx was done Feb. 6, 1933. Removal of the distal phalanx of the right great toe and disarticulation of the left second toe was performed April 24.

Operative Findings. Left second toe: In place of the normal medial and lateral arteries there were three additional moderately sized arteries in the areolar tissue of the plantar surface of the toe, and another smaller artery in the middle of the dorsal areolar tissue.

Plastic operation on the left foot, July 5. The third toe was disarticulated at the metatarsophalangeal joint, and the head of the third

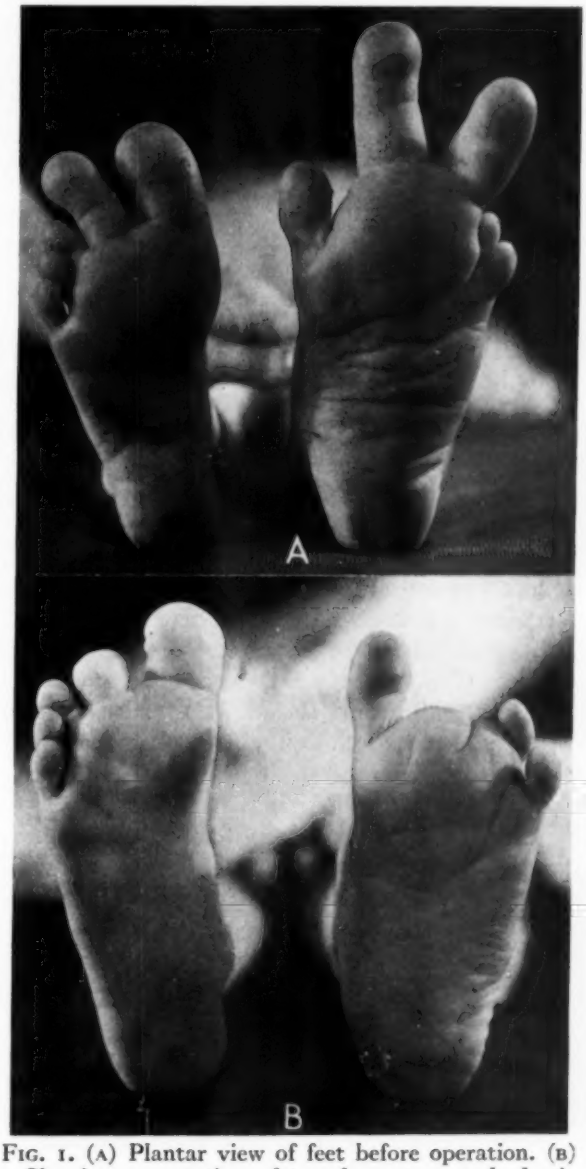

Fig. 1. (A) Plantar view of feet before operation. (B) Showing amputation of two large toes and plastic repair on the left foot and partial amputation of the two large toes on the right foot.

metatarsal was removed together with the epiphysis. The second and the third metatarsal bones were filed smooth. A large vascular pad of fat with the overlying skin was removed from the plantar surface by a wedge shaped incision. Several large pads of fat had to be dissected from the plantar surface before the skin could be approximated.

Plastic operation of left foot, Feb. 5, 1934; resection of the second metatarsal and the

middle cuneiform bones. A longitudinal incision was made over the dorsum of the foot extending the length of the second metatarsal. Dissection was carried through the lymphoid tissue with excision of the entire second metatarsal and the middle cuneiform, resecting the excess tissue on the dorsum of the foot. The distal extremity of the incision was carried forward over the plantar surface in such a manner as to excise a wedge shaped mass of excessive tissue. Two deep retention sutures were placed approximating the remaining metatarsals.

Plastic on left foot, March 26. A curved incision with proximal base was made over the medial surface extending from the head of the first metatarsal posteriorly to the junction of the astragalus and the os calcis. Dissection was carried through the subcutaneous tissue, and the mass causing the bulge on the internal and inferior surface of the foot was found to be hypertrophied muscular bellies of the short flexor and adductor of the great toe. The lymphatic tissue that was present over the dorsum of the foot was not encountered in this region. The two muscles were dissected free from the adjacent tissue and excised. The tendons were anchored. Deep sutures were placed to obliterate the dead spaces, and the incision was closed in the usual manner.

Whirlpool was used daily for the left foot for about three weeks. The patient who weighed forty-eight pounds in 1932, gained eleven and one-half pounds in the year and a half. Smaller shoes were ordered.

SURGICAL RESULT

Measurements taken after the interventions.

Right	*Left*
Length of the sole—20 cm.	20 cm.
Length of the instep—13.75 cm.	13.125 cm.
Width over the base of toes—10.25 cm.	10.1 cm.
Circumference around base of toes—20 cm.	19 cm.
Circumference around ankle—18.125 cm.	18.75 cm.

Right	*Left*
Length of great toe—3.75 cm.	Hypertrophied 2nd & 3rd toes were entirely removed.
Length of 2nd toe—3.75 cm.	
Circumference of great toe around the base—8.75 cm.	
Circumference of great toe around the top—6.25 cm.	
Circumference of 2nd toe around the base—6.375 cm.	
Circumference of 2nd toe around the top—6.375 cm.	

PATHOLOGICAL REPORT

Specimen of Bone from Left and Right Foot. Microscopic: The bony trabecula are prominent and rather thin. The medulla is practically replaced by fat tissue. The periosteum appears to be somewhat thickened with active bone formation. These changes, that is, osteoporosis, fatty degeneration of the bone marrow and osteogenesis, appear to be essentially developmental in character.

Specimen of Hypertrophic Muscle.

Gross: Specimen consists of several irregular pieces of muscle tissue. The individual muscle fibers are quite thick in diameter.

Microscopic: This is a section of striated muscle displaying profound changes irregularly distributed and primarily involving the stroma. The muscle bundles are variable in size, some of them quite large with numerous degenerative changes, as exemplified by the presence of muscle giant cells, swelling and granular changes in cytoplasm and loss of nuclei. The stroma displays a patchy proliferation in which numerous fibroblasts and occasional round cells are seen, all with replacement of normal muscle fibers. What is apparently an earlier stage of the same process is found scattered through the section in the form of rather dense perivascular infiltrations of round cells chiefly of the lymphoid series.

The blood vessels relative to these round cell infiltrations display moderate intimal proliferation and swelling of the intimal cells with, however, only a slight tendency to diminution of the lumen. In some areas the round cell infiltration shows occasional obliterated arterioles.

Diagnosis: Chronic myositis with degenerative changes in the muscle fibers.

BRIEF REVIEW AND DISCUSSION OF THEORIES OF CONGENITAL BONE HYPERTROPHY

The differentiation of congenital hypertrophy of the bone from osteitis deformans,

elephantiasis and acromegalia is usually made without difficulty.

The most important theories of the production of congenital hypertrophy of the bone are:

(1) Mechanical theory, advanced by Slingenberg,[1] associates excessive growth of the bone with twisting of the umbilical cord around a fetal segment, which results in venous stasis with eventual overnutrition and hypertrophy of the involved segment. Cases are reputed in which strangulation marks were present on hypertrophied limbs. Their absence in other cases, he said, may be explained by the fact that the compression of the efferent veins has been strong enough to interfere with circulation but not sufficient to induce marks persisting after birth. In a case reported by Mirau there was twisting of the umbilical cord around a fetal finger which was considerably hypertrophied.

Letuterer and Fischer[2] laid importance on another mechanical factor, namely, defective position of the embryo in utero with subsequent venous stasis and exaggerated nutrition and growth of a body part. Quillon considered pseudomembranous bands in the amniotic cavity a similar causative factor.

When the mechanical compression is slight, circulatory disorders occur slowly; hence, new vessel formations develop as nevi, whereas varices are usually absent.

(2) Vascular theory, promulgated by Cruveilhier[3] in 1856, like the mechanical theory, is based on the conception of a circulatory over-activity. Polosson[4] attributed congenital hypertrophy of the bone to a disturbance of the lymphatic system similar to that in congenital elephantiasis. According to Barwell,[5] bone hypertrophy is due to a deficient development of the muscular layer of the arteries; the resulting dilatation of the vessels causes overgrowth of the parts which they supply.

Trelat and Monod[6] sustained the hypothesis that partial paralysis of the vasomotors leads to a persisting increase of blood supply in some segment of the fetal body. Duzea, in 1886, asserted that the blood circulation plays a prominent part in partial hypertrophy, evidenced by the frequent coincidence of bone hypertrophy with angioma.

(3) Neurotrophic or "nervous" theory sustained by Widenmann[7] and Duplay explains excessive growth by irritation of the central nervous system. Stier[8] stated that changes in the subcortical centers or the cerebral hemispheres are responsible for hypertrophy of the bone.

No significant anatomopathologic lesions of the nervous system were ever determined to support the neurotrophic theory. In Wieland's[9] case a slight thickening of the perineurium was noted, but there were no signs of a degenerative process.

(4) Embryonal theory, first advanced by Cohnheim[10] and later supported by Wagner[11] and Bassel Hagen[12] and others, connects congenital gigantism of the bone with a primary developmental defect of the embryo.

Ahlfeld thought that excessive proliferation of cells in certain parts of the germinal layers leading to a superfluous amount of structural tissue, is the causal factor of bone gigantism. Wieland maintained that such excess of structural tissue is associated with dystrophic processes, namely, pathologic changes of the germinal protoplasm, especially in the middle layer.

A more recent theory promulgated by Kitajgorodskaja[13] is that: Overmaturation of an ovum gives rise to the formation of a superfluous limb bud. Plantation, by way of germinal emigration, of such ovum in an area containing an analogous ovum results in the fusion of two superfluous limb buds with consecutive hypertrophy of a whole limb or a part.

Broca and Massonaud[14] considered as an etiologic factor a yet unknown disturbance of epiphyseal and periosteal bone growth resulting in exaggerated nutrition and subsequent hypertrophy of the bone and the soft tissues.

(5) Other theories: Hereditary influence[15] has not been found by the majority

of writers to be a factor in the occurrence of congenital bone hypertrophy.

The theory of internal secretion holds that the hypertrophy is due to a biochemical reaction causing an irregular distribution of fetal tissues that interferes with the normal glandular secretions. However no correlation between partial gigantism and changes of the endocrine system has been usually observed.

Discussion of theories relating to the present case:

In our case no marks of compression or strangulation which might support the mechanical theory, were present at birth. It seems reasonable to admit that mechanical factors may induce elephantiasic growth of the soft tissues but not that of the bones.

Grieg reported an important mental defect in 20 per cent of patients with a congenital hypertrophy of the bone; and regarded the fact as indicative of a neurotrophic theory. The mental quotient of our patient showed 83, that is, only slightly below the average. No lesions of the nervous system were discovered.

In our patient, the vascular theory would apply as an explanation of the origin of the congenital tumors, that is, the two hemolymphangiomas; however it fails to explain the presence of other congenital defects.

Thus eliminating the three theories, mechanical, nervous and vascular, it seems that the embryonal theory which associates the bone deformity with a general defective constitution is most significant in our case in which several congenital abnormalities, of apparently different nature, coexist.

Spreitzer[16] discussing his case, which resembles closely our own case, is inclined to the theory of a pathologic change in the growth-regulating gene complex, and points out the association of a partial gigantism with a lipoma of the chest. In his case consanguinity of the parents might have promoted the pathologic change.

SUMMARY

(1) This is a case of "true hypertrophy," that is, one in which excessive growth of isolated bones of the feet is associated with voluminous lipomatosis of the plantar surface. The hypertrophy of the bone coexists with (a) two congenital vascular tumors; (b) asymmetry of the face; (c) strabismus; and (d) anomaly of the genital organs.

(2) The occurrence of hypertrophy of the toes is rare; it is even more exceptional that this malformation is combined with other congenital defects.

(3) The statistics show that hypertrophy of the toes is more frequent in males than in females.

(4) The operative findings revealed the presence of additional arteries in the areolar tissue of the hypertrophied toes, satisfying the augmented requirement of blood supply in the segment.

(5) The pathologic report of the involved bone demonstrated the presence of osteoporosis, fatty degeneration of bone marrow and active periosteal bone formation. This corresponds to Wieland's observations. The latter stated, contrary to what was taught by Caubet and Mercade, that hypertrophy of the toe is not a mere quantitative enlargement of the bone, because it presents histologic changes connected with hyperplastic and regressive processes.

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HYPERPARATHYROIDISM WITH VON RECKLINGHAUSEN'S OSTEITIS FIBROSA CYSTICA GENERALISATA AND HYPOPITUITARISM

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THIS report dealing with the study of a case of hyperparathyroidism with von Recklinghausen's osteitis fibrosa cystica generalisata and hypopituitarism is considered of value because of its atypical character, the consequent problems of differential diagnosis and the long period during which the patient was under observation.

History: The patient, J. W., a young married Dutch woman, aged thirty-one, was first admitted to the Battle Creek Sanitarium on November 16, 1930. Her chief complaint was muscular weakness, lameness, rheumatic pain and tenderness in her legs, especially the left thigh. Her illness began seven years previously following shortly after the birth of her last child in April, 1923. Except for one period immediately after the delivery of this child, she had never menstruated since. Shortly before this delivery her left leg began to ache at night after she had been on her feet all day, the pain preventing sleep, and gradually increasing in severity. In driving a car she used her left foot on the clutch, and it would be so weak and tired that she would have to lift the foot off the clutch with her hands. The leg always ached worse at night. She had used aspirin in gradually increasing amounts until her sister remarked at the time of entrance, "she just eats aspirin," without relief from the pain. The leg was not stiff, but when cold the muscles became so hard that she could scarcely move it. Both legs were troubling her on entrance. She felt better after massage relaxation and warmth. She believed the legs were swollen and said they were tender.

She had had her tonsils removed with the hope of relieving the aching in her legs, but there had been no improvement following the tonsillectomy. She then had all her teeth extracted with the same hope, but also without relief. The patient had had no head pains. Her eyes have not troubled her. She has had an abnormal thirst and passes an abnormally large quantity of urine, from five to seven quarts a day.

In February, 1929, a gland in the right groin became very swollen and hard. It was poulticed for several days and then lanced, but there was very little drainage. Nine months later the wound had not healed, and was still draining at the time of entrance to the hospital. Swollen glands in her neck were found that at time. Her bowel action was normal, one or two movements a day.

Family History: Both parents were living, her father was past seventy, had "a little rheumatism for a few days," otherwise he was well. The mother had cancer of the uterus and has since died. The patient had ten siblings, all living and well. Her grandparents on both sides were healthy; her grandfathers both lived to be over ninety.

Previous History: The patient was born in Massachusetts. Her health as a child was good except for measles and frequent attacks of tonsillitis. She had diphtheria as an adult. Her menstruation began at thirteen, was regular, very profuse, usually lasting a week. She was married at seventeen years and had four normal full term deliveries all before the patient was twenty-four years.

She weighed about 170 when she ceased menstruating, but has weighed up to 225 pounds since.

Fig. 1. High magnification. Specimen from left femur. Diagnosis: Decalcified bone shows a hemorrhagic cyst surrounded by granulation tissue, containing numerous giant cells of the bone absorbing type and small groups of atypical round celled sarcoma type. One giant cell, granulation tissue, a few round cells and two areas of bone. Paraffin section, stained with hematoxylin-eosin.

Fig. 2. Left femur, showing mottled, porous bone and cystic degeneration.

There is no history of any other illness in her life.

There are no symptoms at present with reference to her eyes, ears, nose, throat or mouth.

Habits: The patient lives on a mixed diet with large amounts of fruits and vegetables and some milk. Before she became lame she had a great deal of exercise assisting on the farm.

Physical Examination: A woman, 65.6 inches tall, weight 204 pounds, came in on crutches, trunk flexed slightly on the legs, temperature 99.4°F., pulse 96, regular but low tension. Her blood pressure was 110/70. Prognathism, submaxillary, cervical, inguinal and thyroid glands were enlarged. Special search later for parathyroid tumor disclosed nothing palpable. There was no grating in any of the joints. There is sense of stiffness and fullness of the muscles of the left thigh. When passing the hand lightly over the thigh there is a sensation of a swelling of the bone and this area is very sensitive. There is no discoloration of the skin. The patient wears full dentures, but the gums are normal. Pupils are equal size and regular outline and respond normally to light and accommodation. Fundus and perimeter test in November, 1930 and again in July, 1931 were both normal. The liver and spleen were of normal size. The heart tones were

diminished but no murmurs were heard. The lungs were normal. The abdomen presented a heavy fat deposit. Outlines of

Fig. 3. Marked weakness from decalcification from the skeleton. Inability to stand upright.

abdominal organs normal. An open wound from the right labia majora into the groin contains a granulomatous sausage-shaped mass. No pelvic abnormality was present except some laceration of perineum and fairly large hemorrhoids.

Roentgenogram of left thigh November 17, 1930 showed:

"At about the junction of the upper and middle third of the left femur a large cyst-like lesion. It was roughly oval in shape and measured about five centimeters in its longest diameter. The cavity of the cyst was apparently completely devoid of bony trabeculae and in antero-posterior view there was seen to be complete destruction of the inner margin of the femur for a

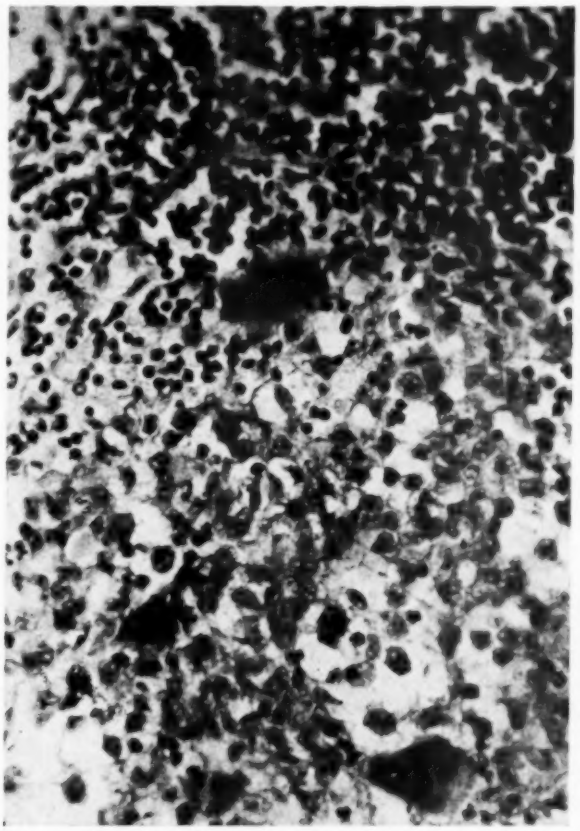

Fig. 4. Magnification 475 ×. Specimen: Granuloma ? from right groin. Diagnosis (A. S. Warthin, M.D.). Extreme proliferation of reticuloendothelial cells, almost neoplastic, with numerous giant cells of bone marrow type. Section paraffin embedded. Stained with hematoxylin-eosin.

distance which measured four centimeters on these films. Midway between this lesion and the lesser trochanter there was a small group of similar lesions exhibiting various lesser degrees of bone destruction.

"A survey of the entire skeleton a few days later revealed a large cyst at the middle of the right femur with two small lesions in the neck of the femur and a moth-eaten appearance of the distal fifth. A few lesions were found in the lower jaw and in the left eighth rib there was a mottled area of decreased density with some expansion of the cortex. This rib lesion was thought by roentgenologist to be characteristic of multiple myeloma."

The basal metabolism reports from −9 to −15 per cent.

The urinary output was 5300 to 5400 c.c. in 24 hours; specific gravity, 10.04, total solids 51 and 49 grams. There was no albumin, sugar, casts, crystals, blood, or any of the indol bodies; occasionally a few pus cells were found. Repeated special tests for the Bence-Jones protein were negative. The stool showed a great deal of putrefaction, some traces of blood, many fatty acid crystals, spore bearing bacteria, and 90 per cent of putrefactive organisms. The blood count always showed a secondary anemia with a count ranging from 2,830,000 to 3,770,000 red cells, 7800 white cells, 55 per cent to 64 per cent hemoglobin (Dare), grams 5.2 to 8.8. (Table 1.) The most noticeable feature of the blood counts has been the variation in the eosinophile count, apparently higher with activity of a lesion and subsiding with its quiescence, ranging from 19 per cent to 3 per cent.

Fig. 5. Left femur, March 26, 1931.

Fig. 6. Left femur, Oct. 23, 1934. The boneless, porous and cystic cavity filling in.

Fractional gastric test showed no free hydrochloric acid present. Histamine test was not made.

The serum analysis of the blood showed by Kolmer a negative Wassermann on November 17, 1930, and November 24. The Kahn test was also negative though patient had been given a provocative dose

TABLE 1

BLOOD CELL COUNT, REGULAR AND DIFFERENTIAL

Date	Hemoglobin			Cell Count per Cu. Mm.		Color Index		Differential Count Per Cent						Morphology
	Dare	Newcomer	Grams Per Cent	Red × 1000	White	Dare	Newcomer	Polymorphonuclear	Eosinophile	Basophile	Transitional	Lymphocytes Small	Lymphocytes Large	
11–19–30	56	46	...	3,610	7,500	78	64	72	3	1	1	23	...	Red cells vary slightly in size, few elongated red cells
12–7–30	59	48	...	3,960	5,100	76	62	54	16	0	1	29	1	Red cells vary slightly in size, few poikilocytes, many elongated red cells
12–28–30	56	46	...	3,600	6,000	78	64	57	11	4	2	25	1	Many elongated red cells
2–22–31	61	50	...	3,730	13,200	83	68	60.5	12	1	0.5	22.5	3.5	Many elongated red cells
4–15–31	49	40	...	2,960	7,800	83	70	60.5	11.5	1.5	1	20.5	2.5	Many elongated red cells
5–8–31	54	44	...	3,080	6,600	90	74	81	6	...	1	12	...	Red cells vary slightly in size; few elongated red cells
6–14–31	58	47	8.0	3,690	9,300	81	66	60.5	14.5	1	...	21	3	Red cells vary in size and shape; few poikilocytes and elongated red cells
7–12–31	58	47	8.0	3,680	9,600	81	65	64	15	1	...	20	...	Few poikilocytes and elongated red cells
8–9–31	53	43	7.3	2,830	8,700	95	77	67.5	17.5	3.5	...	10	1.5	Few poikilocytes and elongated red cells
10–4–31	56	46	7.8	3,360	7,200	85	70	63	19	0.5	1	14.5	2	Few poikilocytes and elongated red cells
11–22–31	55	45	7.6	3,770	5,100	75	61	64	15.5	1.5	0.5	17	1.5	Few poikilocytes and elongated red cells
1–18–32	64	52	8.8	3,950	8,700	83	67	72	7	...	1	17	3	Red cells vary slightly in size
6–1–32	55	45	7.6	3,560	6,000	79	64	65	6	...	...	28	...	Red cells vary slightly in size
9–7–32	52	42	7.1	2,970	5,100	90	73	64	8	2	1	25	...	Red cells regular
9–18–32	44	36	6.1	2,830	11,700	79	64	72	3	1	2	22	...	Red cells regular
10–9–32	41	33	5.6	2,760	6,000	76	61	75	3	...	...	22	...	Red cells vary slightly in size and shape
3–17–33	60	49	...	3,900	8,100	130	106	53	13	...	1	33	...	Red cells vary slightly in size
4–14–33	33	43	7.3	2,710	9,300	99	81	58	15	...	...	26	1	Red cells vary slightly in size
5–19–33	55	45	2.8	3,010	8,700	92	75	55	15.5	1.5	1.5	25.5	1	Red cells vary slightly in size
6–11–33	59	48	8.1	3,660	8,400	82	67	69	15	1	1	14	...	Red cells vary slightly in size
6–25–33	58	47	8.0	3,260	7,200	91	74	70	8	...	...	22	...	Red cells vary slightly in size
9–13–34	43	35	5.9	2,580	6,600	86	70	55	3	1	2	39	...	Red cells regular
10–23–34	54	44	7.4	3,460	8,700	80	65	72	3	2	...	23	...	Red cells regular

of neoarsphenamine. The patient's husband also gave a negative Wassermann reaction. On December 14, 1930, cerebrospinal fluid showed the following: quantity, 4 c.c.; appearance, colorless; cell count, 4 per cu. mm; globulin, (Pandy), trace; ammonium sulphate negative; gold chloride negative; Wassermann negative.

The non-protein nitrogen per 100 cc. of blood was 25.0 mg., uric acid 3.0 mg. and sugar 90 mg.

Tests for the calcium and blood phosphates made throughout the study are shown in the accompanying tables:

Table II
CALCIUM AND PHOSPHORUS DETERMINATIONS ON BLOOD

Date	Mgs. per 100 Cc. Calcium	Mgs. per 100 Cc. Phosphates
11–24–30	10.9	1.9
3–12–31	8.5	3.8
9–10–32	9.0	5.9
9–11–32	10.0	5.1
9–12–32	9.7	4.4
9–13–32	9.0	4.8
9–15–32	9.8	
9–18–32	10.2	4.4
10– 9–32	10.2	3.4
4–14–33	10.4	4.1
6–18–33	10.2	3.6
10–17–34	11.4	5

On December 14, 1930, a biopsy was done on the gland in the right groin. In January 1931 this tissue was reported by Dr. A. S. Warthin as follows: "Negative for spirochetes. Tissue presents the appearance of an infected hemorrhagic bubo, but there are several *atypical cell nests and numerous large giant cells.* The typical cell nests suggest very small metastases, but the appearances are not conclusive. Our general impression is that this is a severe bubo."

Summarizing the outstanding symptoms in the case up to this point, we have:

1. Marked muscular weakness with inability to stand upright
2. Deep, severe pain in the left thigh with swelling and tenderness over a localized area in the femur
3. Bilateral, general enlargement of the lymphatic glands
4. A secondary anemia
5. Variable but well marked eosinophilia
6. A normal blood calcium but rather low blood phosphate
7. Absence of Bence-Jones protein
8. *X*-ray evidence of osteoporosis with multiple bone cysts
9. Well marked polydipsia and polyuria
10. Total amenorrhea from age of twenty-four years
11. Obesity, principally abdominal
12. Slightly lowered basal metabolism
13. Prognathism

On these grounds a tentative clinical diagnosis was made of generalized osteitis fibrosa cystica or Von Recklinghausen's disease with hyperparathyroidism and hypopituitarism.

On February 23, 1931, the patient was admitted for an enucleation of the granulomatous mass in the right groin and for a biopsy on the cyst in the left femur. The surgeon, Dr. Arthur H. Kretchmar, reported on the left femur:

"The cavity in the bone, at the upper part of our incision, could be palpated beneath the periosteum. The periosteum was opened, split upwards and downwards, and a good sized cavity in the femur was opened into. The bone was open on its posterior and inner aspect, the edges of the opening were very sharp. The sharp edges were bitten away with bone biting forceps. The cavity was very irregular, penetrating deeper in some places than others, and the same lined with a glistening membrane. There was no fluid or granulation tissue within the cavity.

"The *lining* was thoroughly curetted away, also the bits of bone from the edge of the opening and the lining tissue were curetted away and preserved for pathological study. Wound was closed in the usual manner."

In the center of the old wound in the right groin was a purplish granulomatous,

friable mass. Utilizing the cutting current this was removed strip by strip and found to extend beneath Poupart's ligament and into the saphenous opening, measuring at least 4 inches in depth. The bleeding points were ligated. Indoform gauze was packed down into the depth and two tension sutures were used to bring together the skin and deeper fatty tissue.

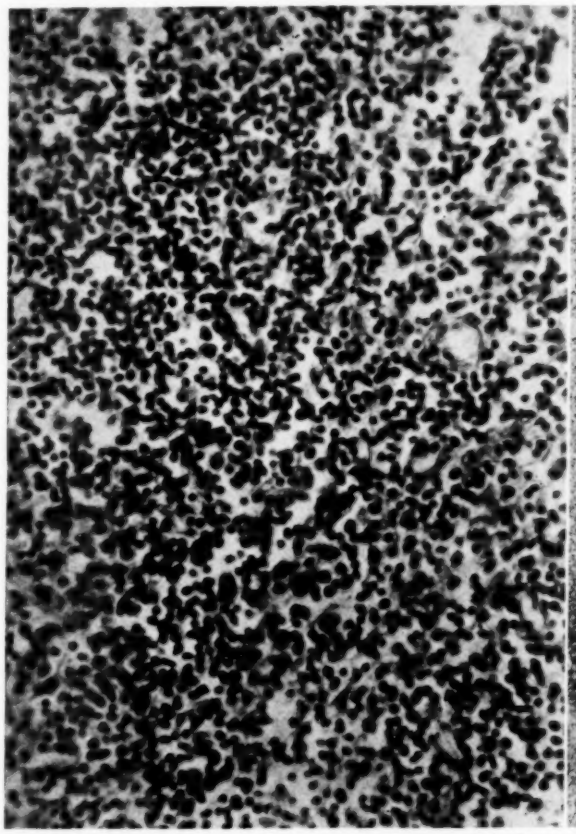

Fig. 7. High magnification. Specimen from cyst lining from bone cavity. Diagnosis: (A. S. Warthin, M.D.). Round cell sarcoma. Lymphoblastoma of myeloma type. Paraffin section stained with hematoxylin-eosin.

Fig. 8. Low magnification. Specimen: Granuloma? from right groin. Diagnosis (A. S. Warthin, M.D.). Extreme proliferation of reticuloendothelial cells, almost neoplastic, with numerous giant cells of bone marrow type. Section paraffin embedded, stained with hematoxylin-eosin.

Precaution was used to prevent any fracture of the leg which could easily have occurred as the bone cyst involved more than 50 per cent of the circumference of the femur.

The pathological report made by Dr. A. S. Warthin on "cyst lining from bone cavity" was: "round cell sarcoma, Lymphoblastoma of myeloma type." The tissue from "Granuloma (?) from right groin" was: "Same picture as before. Extreme proliferation of reticulo-endothelial cells, almost neoplastic, with numerous giant cells of bone marrow type." "In view of this material, this patient has a multiple neoplasm of bones falling into the group of lymphoblastoma or myeloma with metastases in inguinal glands. The case is of particular interest because of the appearance in the inguinal gland of large numbers of giant cells of bone marrow type. It would appear to be a metastasizing bone marrow tumor."

Deep *x*-ray therapy to the cystic area in the bone and Coley's fluid intravenously were instituted.

From the beginning the patient had been on a diet rich in calcium and vitamins and low in carbohydrates and received calcium lactate, 10 grs. t.i.d., a small amount of thyroid extract and whole gland pituitrin.

Later the thyroid was discontinued and she was given Viosterol, 250 D., and ultraviolet radiation to the body.

Fig. 9. Right femur, August 9, 1931.

Late in March her glandular enlargement had increased very decidedly; glands filled the submaxillary triangle and the cervical region. Repeated *x*-ray study of the bones showed a very rapid progress of the disease. A new area in the left eighth rib showed mottled, decreased density with some expansion at the cortex.

Up to June, 1931, although the patient had lost steadily in weight, so that on June 14th she weighed 179 pounds, she reported very little aching remaining in the left leg or thigh. Her trunk seemed to be more flexed on her thighs than formerly but *x*-ray films showed no abnormality of the vertebra. The glandular condition seemed unchanged. Polydipsia and polyuria persisted still.

A check-up *x*-ray examination of the

Fig. 10. Lesion in left clavicle, Feb. 17, 1933.

bones about this time showed no material improvement, in fact the right thigh appeared to be worse. By the middle of July there was increased soreness, tenderness and pain in the right thigh but no soreness in the left thigh since the biopsy. The *x*-ray pictures showed an increase in the size of the cyst in the right thigh.

In August, 1931, the submaxillary and cervical glands were still more enlarged and her blood count had gone down again, though the eosinophiles were up to 17.5 per cent. She was therefore transfused. In September the patient was still complaining of a great deal of pain in the right thigh and the glands in the neck had further increased.

Early in October, 1931, we noted more enlargement of the axillary glands. There was still a great deal of pain in the right thigh and also pain in the back. The eosinophiles were 19 per cent. By December the pain had begun to subside again and the patient looked and felt better, the glands in the neck were smaller. The

eosinophiles were now 15.5 per cent and January 18, 1932, were only 7 per cent.

X-ray films in February, 1932, showed a

Fig. 11. Left femur, March 17, 1933, showing progressive activity in new lesions.

decrease in the size of the lesion of the left femur, though it was increasing in the right leg. In March the swelling in the right thigh had disappeared entirely and it was no longer painful, and she was beginning to regain weight. There was still a great deal of doubt of the diagnosis, with preponderance of opinion for multiple myeloma.

In the spring of 1933 Dr. Plinn Morse, writing with reference to the case, said: "The question of multiple myeloma can quite often not be settled on the basis of the clinical data which we possess. The *x*-ray findings, blood calcium and chronaxie of advanced multiple myeloma are all identical with osteitis fibrosa cystica, and

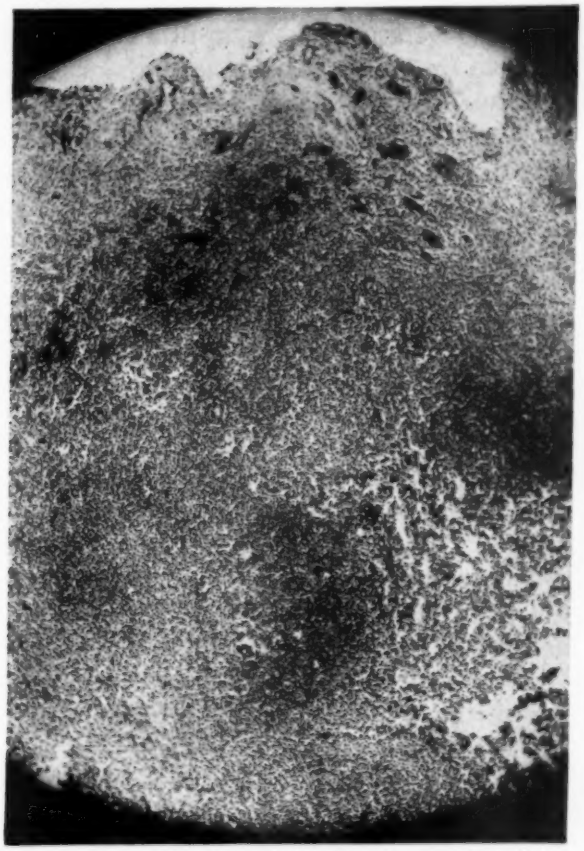

Fig. 12. Magnification 65 ×. Specimen: Cyst lining from bone cavity. Diagnosis: (A. S. Warthin, M.D.). Round cell sarcoma. Lymphoblastoma of myeloma type. Paraffin section, stained with hematoxylin-eosin.

the only way to differentiate is to do a biopsy on a point in the skeleton which looks most suspicious in the *x*-ray of multiple myeloma, and make the decision directly from the section.

"There has been suggestive evidence that multiple myeloma may be a malignant form or end-stage of osteitis fibrosa cystica. Some years ago I published an article on Multiple Myeloma of the Bones (*Jour. of Cancer Research*, Vol. 5, No. 4, Oct. 1920) in which I came to the conclusion that multiple myeloma of the *plasma cell type was really of osteoblastic origin and not related to the blood forming or marrow tissue.*"

In June, 1932, roentgenographic check-up of the entire skeleton revealed the follow-

ing: In the skull was a small punched out area close to the upper margin of the right parietal bone. This was the first time we had found a lesion in the skull. *The lesion in the eighth rib now appeared as two small cysts.* The cortical expansion seen in November, 1930, had disappeared. *There was a deformity in the lower third* of the right humerus which appeared to have been caused by the healing of an old fracture. The large lesion in the middle of the left femur showed little if any change, but numerous small lesions appeared above and below it. The large lesion in the middle of the right femur was increasing in size, and there were also numerous lesions above and below it. Two small lesions appeared to be in the right ilium and a group of three or four were in the upper part of the left ilium. In the head and neck of the left femur we found a number of small areas of decreased density and in the head of the right femur was a large area of decreased density measuring at least an inch in diameter.

By this time the differential diagnosis had been narrowed down to either multiple myeloma or hyperparathyroidism. Because of the generalized enlarged glands our surgeon, still questioning the diagnosis and feeling that with such extensive metastases, as proved pathologically, nothing would or could be accomplished, hesitated to explore for parathyroid adenoma. We had been unable to palpate anything that might be taken for a parathyroid tumor in the neck. Dr. Kretchmar later in the year discussed the case with Dr. Max Ballin. Since one case had been relieved by parathyroid surgery, even though the patient had had *glandular enlargement*, the surgeon became less skeptical about surgery.

An exploratory operation for possible parathyroid adenoma was done September 9, 1932. "On the right side at the point where the inferior thyroid vessels divided, was what appeared to be an enlarged parathyroid, or parathyroid adenoma about 1.5 cm. in length, 1. cm. in width and .33 cm. in thickness. The left side was then explored and two small glands were found on the posterior surface of the thyroid which resembled parathyroid glands. About two-thirds of the glands on the left side and all of the tumor on the right side were excised, thus forming what we believed to be a partial parathyroidectomy. The pathological examination disclosed that what had been supposed to be parathyroid adenoma was not parathyroid tissue at all."

Three days later the surgeon reopened the incision. "Owing to the nodular state of the left lobe of the thyroid a left lobectomy, right down to the posterior capsule, was carried out. A small, hard body, about ⅜ inch in diameter was encountered on the side of the trachea and this was also removed. The thyroid fascia was opened posteriorly and finger exploration upward and downward and in back of the esophagus was carried out but no tumor was found."

Blood calcium following the first operation was 9.0, 9.6 and 9.7 mg. per 100 c.c. Blood calcium following the second operation was 9.0, 9.7, 9.8, 10.2 mg. and phosphates 5.9, 5.1, 4.4. mg.

By the latter part of December, the glands in patient's neck were definitely smaller and gradually disappeared entirely.

On September 30, 1932, the patient reported a slight sign of a menstrual period. On November 6th she had quite a normal three-day menstrual period. After that time there was a period every other month, some more normal than others. This continued through August, 1933, after which the function ceased.

On November 13, 1932, checking up by *x*-ray, the one lesion which had been operated on was filling up, all the others were worse than they were when the last *x*-ray was taken in June, 1932.

In December, 1932, a study of the calcium balance was made. Patient was hospitalized and put on a carefully analyzed diet and distilled water, under the strict care of an experienced dietitian.

For a three day period all the urine and stool were collected, a charcoal tablet being used as a marker at the beginning and end of the diet period.

RESULTS

	Mgms.
Total excretion of calcium for 3 days..	1538
Total intake of calcium for 3 days.....	1224
Excess elimination over intake.....	314
Negative balance of.....	25.7 per cent

In February, 1933, the patient complained of a sore, tender place about the middle of the left clavicle and her left arm was quite helpless. This lesion appeared to be exactly the same kind as those in her legs. An *x*-ray showed a cyst in the center of the clavicle. The glands in the neck still continued to diminish in size.

X-ray of dorsal spine and ribs in March, 1933, showed no evidence of a vertebral lesion. The two small cysts in the left eighth rib were still present as well as an early new lesion situated about two inches proximally and another irregularly oval cystic area in the left sixth rib, close to the articulation.

In April, 1933, the cyst in the left clavicle was still active. The blood count dropped but the eosinophiles rose. One lymphatic gland in left cervical region was enlarged and active.

In June, 1933, the lesion in the left clavicle showed improvement over the findings of February 17, 1933. No lesion of the scapula was recognized, but there was a suspicion of involvement of the surgical neck of the humerus. The right shoulder showed no evidence of lesion.

During the summer of 1933, an enlarged gland in the left inguinal region broke through the skin, resembling the granulomatous mass originally found in the right groin. During the following winter this gradually subsided and finally disappeared. The patient returned to her home and was not seen from December 1933 until the latter part of October 1934, when she was admitted for check-up routine. She was considered more deformed than when seen about ten months previously, her height had diminished nearly a foot, her trunk was flexed on her legs to more than right angle when attempting to stand and her legs were strongly flexed on thighs. From the *x*-ray apparently this was not due to any retrograde condition in the bones but rather to sitting constantly in one position until she was no longer able to straighten out her legs. She had gained twelve or fifteen pounds weight. Physical examination revealed nothing new other than this greatly increased deformity with associated pain and stiffness in both knees. A seropurulent discharge persisted from both groins though the enlarged lymphatic glands had entirely disappeared, as well as in the cervical and axillary regions. Residual soreness in the left thigh but no aching was present.

Polydipsia and polyuria were about the same. Blood chemistry showed an increase in the non-protein nitrogen to 40.9 mg. blood calcium 11.4, mg. and blood phosphorus 5 mg. per 100 c.c. The blood count was practically unchanged except that there was a total absence of eosinophiles. The urine for the first time showed albumin 5 per cent per volume.

X-ray examination of all the bones was rendered difficult from a technical standpoint by the fact that the patient's legs and trunk were fixed in the sitting position, together with a gain of thirty pounds in weight. No new lesions were found and all the old ones showed a very definite improvement.

After patient's return home, the conditions remained stationary except for occasional gastrointestinal upsets with cramping pain, vomiting and purging until the middle of January, 1935, when she became acutely ill with what her local physician diagnosed as a heavy "bronchial cold." She died February 8, 1935. During the last illness the diarrhea was so profuse as to require diapering. In the last few days patient was stuporous. There were slight attacks of rigidity with convulsive twitchings.

Because this case did not conform to the classic and typical descriptions of any of the bone tumors it has been difficult from the onset. Nevertheless, after careful study, it was diagnosed as in the foregoing and so presented to the Staff of the Battle Creek Sanitarium in April, 1931. It aroused a good deal of discussion and there was a variance of opinion as to the diagnosis, revolving particularly about hyperparathyroidism with generalized osteitis fibrosa cystica and multiple myeloma. The normal blood calcium and phosphate were at that time considered by many as very much against hyperparathyroidism.

Dr. Russell Wilder in a personal communication to me about that time said:

"Usually the blood calcium is elevated, but the progress of the disease is probably an intermittent one, and patients are likely to come in in an inactive stage with normal blood figures. A low or normal blood calcium, therefore, does not exclude hyperparathyroidism. By the same token a high blood calcium does not prove the presence of hyperparathyroidism since high figures are seen in other conditions of rapid bone destruction, for instance, a condition such as metastatic carcinoma."

The fact that the history of this patient's illness covered a period of fourteen years, the last four and a half years under observation, and that during that time she gained weight rather than lost was against the diagnosis of multiple myeloma.

Dr. Warthin's pathological reports on the biopsy specimens were thought to favor a diagnosis of multiple myeloma with glandular metastasis, but when the glands gradually but completely disappeared, another point was made in favor of hyperparathyroidism.

While we found no adenoma of the parathyroid, even after careful search, parathyroid tissue was removed and improvement followed both in the gland condition and in the bones, but not sufficient although it appeared as if there still might be parathyroid adenoma somewhere in the mediastinum. DuBois studied a case in which at operation no tumor was found, nevertheless, two normal appearing parathyroid glands were removed. Afterward the blood calcium was a little lower and the *x*-ray revealed a deposit of calcium in the bone. The patient gained strength and in four months was able to work in an office eight hours a day. In this instance there was hyperfunction of the parathyroid gland in the absence of any noticeable hypertrophy.

In the case reported by Barr, Bulgar and Dixon,[5] their patient had a tumor of the maxilla diagnosed previously as a giant cell tumor on biopsy. They reported the tumor as becoming smaller.

Rowntree and Allan of the Mayo Clinic were present when this case was presented and they recognized a similarity between that case and one observed in their clinic[6] as hyperparathyroidism and completely studied from that standpoint. Dr. Russell M. Wilder[7] of the Mayo Clinic, in commenting on these cases, said:

"In the cases of hyperparathyroidism thus far reported the disease was in adult men or women and produced either by tumor (adenoma or carcinoma) of a parathyroid gland or, as in the case of DuBois, by *hyperfunction of otherwise normal parathyroid glands.*

"The fact that a tumor was not found in DuBois' case is interpreted as indicating that hyperparathyroidism may result from the hyperfunctioning of otherwise normal glands. It is impossible to account for the giant-cell tumors which occurred in the case reported here and also that of Barr, Bulgar and Dixon.[5] Such tumors have been noted previously in association with osteomalacia and osteitis fibrosa. It is remarkably interesting that following parathyroidectomy in the case here reported a tumor of the maxillary bone disappeared, or at least decreased in size, to such an extent that it was no longer palpable."

We also know[10] that "parathyroid tumors may be deeply situated behind the trachea or even in the mediastinum."

COMMENTS

(1) In this case perhaps one of the most noticeable features has been the practically normal blood calcium and blood phosphorus at all times, though the research to obtain the calcium balance done in December 1932 showed a negative balance of 25.7 per cent.

(2) Another unusual feature which delayed parathyroid surgery was the marked glandular enlargement almost equaling that seen in Hodgkin's disease and the metastasis of large numbers of giant cells of the bone marrow type into these glands.

(3) The eosinophilia, apparently varying with the activity of the disease, is a feature that I have not seen recorded previously. One pathologist, reporting on the lining of the bone cavity said: "the cytoplasm of practically every cell contains granules of eosinophile type." The question of eosinophilia in osteitis fibrosa cystica was discussed by Dr. Harold H. Sanguinetti, of London, with Dr. Donald Hunter, who in turn referred it to Dr. Janet Vaughan, who has been studying the relationship of disordered hemopoiesis to bone disease. In her report she said: "In 7 authenticated cases with a parathyroid tumor there is no eosinophilia." Dr. Sanguinetti, in a personal communication, expressed the opinion that the increase in the number of eosinophiles during the development of a fresh cyst favors the diagnosis of osteitis fibrosa cystica, for a breakdown of proteids resulting in the formation of such a cyst and their absorption would be likely to lead to an increase of eosinophiles.

(4) The amenorrhea at twenty-four years of age has been another unusual feature of the case and one I had difficulty in attributing to the parathyroid disturbance. May it not be that the patient's size, suggesting acromegaly, the prognathism, the type of the obesity and the fine soft skin, were in the beginning due to a hyperpituitarism, or increase in acidophilic cells, and that later on the amenorrhea may have been an expression of the compression of residual normal elements?

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BENIGN BONE CYST*

A REPORT OF 3 CASES LOCALIZED IN THE HUMERUS

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INTRODUCTION

THREE adolescents with fractures through bone cysts in the humerus were admitted within one month in the summer of 1934, to the Orthopedic Department of the Receiving Hospital. Fracture with minimal trauma, and without previous symptoms of bone cyst or bone tumor had been noted in each instance. They were treated conservatively and all healed with varying prognoses, as judged from radiographic and clinical examinations. One case came to operation about a year later with a good result while the other two are continuing conservative therapy. It is proposed to summarize these cases with the end result of each and to review briefly our present knowledge of the condition.

ETIOLOGY AND PATHOGENESIS

The benign bone cyst usually occurs in adolescents[2] under twenty years of age and a case has been reported in an infant.[6] Females are more subject to them than males.

Theories as to their origin are not numerous but the question is still unsettled. Bloodgood states that the etiology is unknown. Their derivation from a traumatic hematoma of the medullary portion of the bone first postulated by Beneke (quoted by Brunschwig[5]), is reemphasized by Lang,[8] but trauma is not a factor according to Bloodgood.[2] Virchow's theory was that of a degenerating cartilagenous tumor. Localized osteitis fibrosa has been suggested. Phemister[12] and his co-workers[5,13] postulated an infectious origin and believed that the benign giant cell tumor had a similar origin. This view was based on the fact that he found giant cells in the lining of a benign cyst. Santos[13] showed that apparently normal bone marrow may infrequently contain staphylococcus aureus and subtilis bacillus. Streptococci and staphylococci, according to Santos are recoverable from the contents of solitary bone cysts. Cysts and osteitis fibrosa cystica may arise from either local or general processes (Bloodgood).

PATHOLOGY AND MICROSCOPIC FINDINGS

A benign bone cyst may have a connective tissue lining or no lining at all or it may be filled with connective tissue showing signs of chronic inflammation.[2,4,12] Occasionally cartilage and giant cells are found in the bloody fluid contents in the benign bone cyst. The degeneration of a cartilagenous or benign giant cell tumor might be postulated from these findings (Phemister).

The case which came to operation showed only marrow fat within the cyst and no connective tissue lining. The periosteum was thickened due to low grade chronic inflammation. The decalcified sections of the cyst wall showed hypertrophic and sclerosed bone. Sections were examined by Dr. O. A. Brines, Pathologist.

SYMPTOMS AND X-RAY FINDINGS

The patient with benign bone cyst is probably most frequently brought under medical care for the treatment of a fracture the result of minimal trauma;[2,6] Bartlett's case[1] and one of ours threw a baseball. On the other hand, the patient may present

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himself with swelling, pain, tenderness, shortening, bowing and atrophy or any combination of these;[5] and egg shell crackling may be present.[14]

Radiographic examination reveals a localized and well circumscribed area of uniform rarification in the diaphyseal porion of the bone.[10,11] The cortex is thinned as the cyst increases. There is no periosteal reaction. Evidence of filling in of the cyst after fracture[4] or surgical treatment[9] is best seen in the radiograph. That a central bone lesion cannot be adequately diagnosed radiographically is emphasized by Bloodgood.[3]

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

The diagnosis depends on the history, the physical examination and the radiograph[7] which shows the bone lesion in the diaphysis near the proximal end. Periosteal reaction is absent and only a thin shell of cortical bone encases the cystic area.

The principal function of differential diagnosis is to rule out malignant central bone tumors. In sarcoma[7] there is a longer duration of symptoms, earlier fracture and expansion of the bone and periosteal changes as seen in the radiograph. Echondromas are usually epiphyseal in position. Central sarcoma, fibrosarcoma, myxoma and solid osteitis fibrosa occasionally are difficult to differentiate from benign bone cyst but fortunately are rare and microscopic study of excised tissue may give the clue to its malignancy or benignancy.[3] When syphilis is present, the serological reaction of the blood should show it and there is often a periostitis. Tuberculosis is eliminated by clinical signs and increased bone density. Abscesses show sclerosis and irregular walls with sequestrum formation. Cyst due to subperiosteal hematoma and callus cysts occur occasionally and are eliminated by the history of trauma, fracture or scurvy. Multiple cysts[2] occur in osteitis fibrosa, osteitis deformans, osteomalacia, echondromata, sarcoma and in mercurial poisoning. Multiple radiographs will demonstrate these conditions. Fifty per cent of giant cell tumors are in the lower end of the radius and all recover (Bloodgood).

TREATMENT

"The best treatment of a bone cyst is a comminuted fracture."[4] In all of our cases fracture was followed by solid healing although this was not painless in one. (Case III.) Operation should probably be advised for all progressive central lesions of bone, to break down the wall in benign lesions and remove tissue for microscopic examination in the case of suspected malignancy.

PROGNOSIS

Treated as a fracture[6] or operated[3,5,9,10,11] they usually do well and rarely give rise to further trouble.

CASE REPORTS

Case I. I. G. On August 2, 1934 a husky white female, age thirteen fractured her right humerus in attempting to throw an indoor baseball. There was no history of pain in her right arm previous to her injury and she had never suffered a fracture of any other bone. The past history of the patient and the family history were essentially negative. Physical examination except for the obvious signs of fracture of the right humerus was negative.

Radiographic examination of the right humerus revealed an oblique fracture at the junction of the upper and middle thirds. The fracture extended through the lower end of an oval unilocular cystic area, 3 cm. in length, its walls extending outward nearly to the limits of the cortex.

The value for hemoglobin was 13.2 grams per 100 c.c. of blood. There were 4,280,000 erythrocytes and 13,800 leucocytes per c.m. of blood. The blood smear revealed 56 filamentous, 8 non-filamentous polymorphonuclear neutrophiles and 36 lymphocytes in 100 cells. The Kline test for syphilis was negative. The value for the serum calcium was 11.1 mgm. per 100 c.c. of serum and that for serum phosphorus 4.7 mgm.

The arm was treated for four weeks in a Thomas splint with traction on the distal fragment by means of a Spanish windlass.

She was discharged from the hospital with the forearm in a sling and a coaptation splint about the fracture site on September 5, 1934.

She returned for reexamination on March 13, 1935 and was found to have a normally functioning extremity without weakness. There were occasional light pains at the fracture site. Radiographic examination at this time showed that the fracture had healed. The bone cyst had not diminished in size and the cortex of the bone was quite thin. Because she had no symptoms operative interference either by bone transplant or by crushing of the cyst wall and removal of its contents was refused by her parents.

The prognosis in this case is refracture through the cyst wall with minimal trauma.

Case II. G. M., a white male of Syrian extraction, aged eleven years was admitted on July 7, 1934 with a history of falling from a fence, sustaining a break in the shaft of the left humerus. The past history of the patient and his family were irrelevant. The patient had had no previous fractures. Physical examination was negative except for the fracture of the left humerus.

Radiographic examination revealed an irregular transverse fracture of the upper third of the left humerus through an area of cystic degeneration.

The value for hemoglobin was 12 gms. per 100 c.c. of blood. There were 8850 leucocytes per cm. of blood and the smear showed 63 filamentous and 5 nonfilamentous polymorphonuclear leucocytes and 32 lymphocytes. Other laboratory tests were not recorded.

The arm was treated in a Thomas splint with Spanish windlass traction for a period of four weeks and he was discharged from the hospital on August 10, 1934.

The patient returned March 13, 1935 and at that time had slight weakness of the left arm. Movements were normal and painless in all directions. Radiographic examination revealed some obliteration of the cystic area in the upper third of the humerus with a fairly competent looking cortex about the cystic area. The parents had previously been considerably perturbed by the prospect of operation so they were advised that the boy had a fairly strong arm but that there was a possibility of refracture through the cystic area in the left humerus.

Case III. A white female, age fifteen was admitted August 3, 1934 with a history of falling from a slide. There was a fracture of the left humerus but no other injuries were noted. She had never had a previous fracture and there had been no pain or weakness in the left arm at any time. The patient's past history and her family history were negative.

The arm was dressed in a Thomas splint and radiographic examination showed an oblique fracture at the junction of the upper and middle thirds of the left humerus with the fracture extending through an area of cystic degeneration. Portable radiographs showed beginning healing of the fracture at the end of three weeks; motion was started at the elbow and the patient was discharged to the Out Patient Department with her arm in a sling.

Laboratory examinations showed a normal urine and a negative Kline test for syphilis. There were 12.8 gms. of hemoglobin per 100 c.c. of blood and 3,720,000 erythrocytes and 9900 leucocytes per cm. of blood. The differential smear showed 62 filamentous and 12 nonfilamentous polymorphonuclear leucocytes and 26 lymphocytes. There were 10.4 mgms. of calcium and 4.8 mgms. of phosphorus per 100 c.c. of blood.

The patient returned March 13, 1935 and reexamination demonstrated that motions in all the joints of the left upper extremity were normal, but there was weakness of the left arm and the patient complained of pain in the old fracture site. There was no atrophy of the shoulder or arm muscles and the grip of the left hand felt as strong as that of the right. Radiographic examination showed partial filling in of the cystic area with complete obliteration of the fracture site. The patient continued in this condition until July 13, 1935 when operation was advised to allow complete filling in of the cystic area and strengthening of the humerus by callus and new bone formation.

Incision was made on the outer aspect of the upper third of the arm and the periosteum was reflected from the cystic area. A trephine opening was made with chisel and a rongeur served to remove most of one side of the cyst wall. The contents of the cyst and portions of its wall were sent for microscopic study. There was no lining of the cyst and the contents had the consistency of soft butter. The soft parts were allowed to fill in the cavity and the wound was closed tight. An airplane spica was applied.

Microscopic study of the cyst wall and its contents was made by Dr. Brines: "The sec-

tions of soft tissue in themselves are not diagnostic, consisting only of a small amount of marrow fat, thickened periosteum and calcified material which is apparently not bone but represents a lime salt deposition. The decalcified sections consist of hypertrophic and sclerosed bone. No cyst wall can be identified. The periosteum is thickened apparently due to low grade chronic inflammation."

Beginning healing with callus formation was revealed on radiographic examination five weeks after operation when the cast had been removed.

CONCLUSIONS

1. Three cases of benign bone cyst of the humerus are reported.

2. The etiology of the benign bone cyst is unknown.

3. Fracture with minimal trauma is the most frequent early symptom.

4. A localized, well circumscribed area of uniform rarefaction in the central portion of the proximal diaphysis of the long bones with a thin cortical shell is seen on the radiograph.

5. The history, the age of the patient, the radiographic examination with later follow up establish the diagnosis.

6. The treatment is that of the fracture or surgical evacuation of the cystic contents and crushing of the bony wall.

7. The serum calcium and phosphorus is unchanged in cases of benign bone cyst.

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ACUTE PUERPERAL INVERSION

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THIS condition is referred to as acute if it occurs within a month after delivery. Thereafter it is known as chronic inversion.

When the fundus remains within the external os the inversion is incomplete. A partial or complete protrusion of the fundus through the external os is known as complete inversion. There may be an accompanying prolapse, causing the corpus of the uterus to extend to or through the introitus, governed to a great extent by the degree of laxity of the cervical supports as well as the patulence of the cervix. The vagina may be involved in the prolapse. The cup formed by the completely inverted uterus, will of necessity, contain the tubes and ovaries, broad ligaments, part of the bladder, and possibly omentum and gut. Strangulation of any of these structures may be caused by a constricted cervix.

Inversion is regarded as the rarest obstetric accident and almost always occurs immediately after delivery; although Hypher[1] states that he encountered one that occurred seven days after delivery. Williams[2] stated that many obstetricians had never seen a case; and at the St. Petersburg Lying-in Hospital not a single case had occurred in 250,000 labors. Findley[3] quoted the Vienna Lying-in Hospital as having one case in 280,000; also several authors who had reported none in 200,000 deliveries. Phanauf[4] believes that the condition is becoming less frequent because of improved obstetric teaching, and mentions an incidence of one in 125,000 labors. DeLee[5] states that in 250,000 deliveries Braun did not see a case; and in Dublin one was observed in 190,000 labors. Because of the inferior type of obstetrics practised by midwives, they see more of these cases than the obstetrician.

It is estimated that 85 per cent of inversions are of obstetric origin and 15 per cent due to traction of an intrauterine tumor. Factors involved in the etiology of the former type are an atonic uterus with a patulous cervix. Effort to express a placenta from a uterus that is not contracted, traction on a cord, either because of shortness or being twisted around the fetus, or in an effort to free the placenta, will help to cause inversion. Any increase in intra-abdominal pressure, such as vomiting, coughing or sitting up in bed, may have a similar effect. In 1793 White[6] was called to see a patient with a retained placenta. The patient was standing while the midwife was making traction on the cord. Not meeting with success, the woman was made to cough and sneeze. The midwife then caused her to vomit by tickling her throat while continuing traction on the cord. Except for the etiology, White's description of this case is in so many respects identical with mine, as to again warrant reference to it at an appropriate place in this paper. Rucker[7] regards inversion as analogous to intestinal intussusception; first there is a dimpling of the placental site, then a cupping, and the uterus contracts in an effort to throw out this mass, much as it would a foreign body, thus completing the inversion.

Hemorrhage, shock and pain are the symptoms in their probable order of importance. The hemorrhage may be due to a partial separation of the placenta, or open sinuses of a relaxed uterus, especially at the placental site. Most authors believe that the inversion itself causes shock. Since Rucker[7] was able to invert a uterus by making traction on the cord, and then

while the patient was out of anaesthesia, remove the placenta and replace the uterus without any subjective or objective symptom, he feels that inversion itself does not cause shock, but that it is caused by strangulation. Browne[8] attributes shock to compression of the ovaries in the cervical constriction similar to that produced by the injury of a testicle.

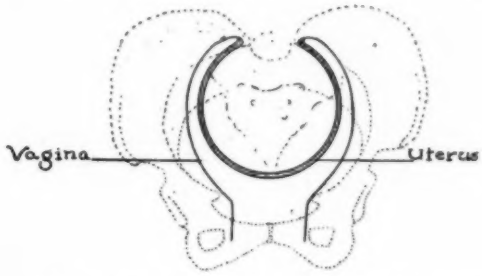

Fig. 1. Shows hand palpating completely inverted uterus.

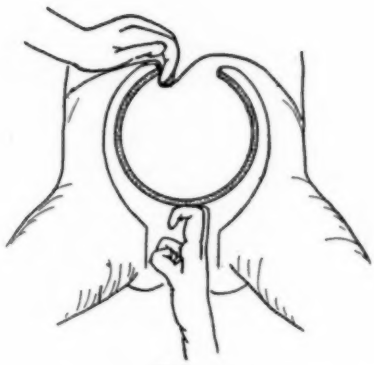

Fig. 2.

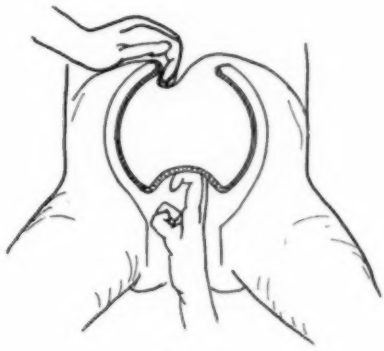

Fig. 3.

Fig. 2. Reduction by taxis. The rim of the uterine "cup" is grasped by the external hand, while upward pressure is made by the flexed index and middle fingers of other hand. Thus perforation of uterus is avoided.
Fig. 3. Uterine body is indented and reduction started.

Time is an important element in treatment. The difficulty of replacement may be regarded as being in direct proportion to the time elapsing since occurrence. Other factors governing action are the amount of hemorrhage and shock. Some authors caution not to replace the fundus during shock, but to pack the vagina around the uterus and treat palliatively. My patient had lost so much blood and was in such extreme shock, that I considered it a lesser risk to act immediately. Transfusions and infusions are of great help at this time. During the process of reduction by taxis, many a uterus has been perforated. Therefore, when the placenta is attached to the prolapsed fundus, if the cervix is not too constricted, it is well to remove the placenta after reducing the inversion, and thus avoid this danger. Should the cervix be constricted or hemorrhage profuse, the placenta had better be removed first. All active treatment should be done under anesthesia. Chronic inversions are now treated by various operative procedures. Since this leaves the uterus with a scar, the patient must receive the same consideration during a subsequent pregnancy as if she had had a previous cesarean section. White[6] suggested the use of a repositor to be used in acute cases, to which reference will be made again. Aveling[9] was successful in reducing a chronic inversion by the use of his repositor.

It is my opinion that recurrence is more apt to be obtained immediately after replacement than at any other time, including subsequent deliveries. Some authors state that recurrence never happens. Although Miller[10] refers to a patient of Emmet who was pregnant five times after

an inversion and never had a recurrence, he says that recurrences occur in 26 per cent of cases in subsequent pregnancies.

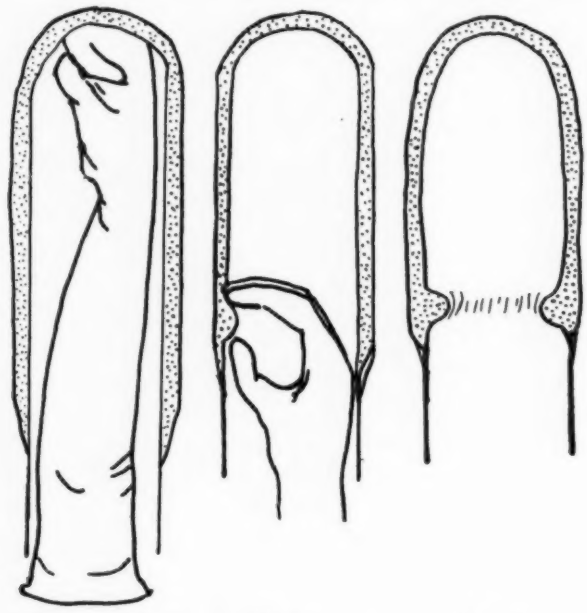

Fig. 4. Fig. 5. Fig. 6.

Fig. 4. Reduction completed. Birth canal greatly elongated and relaxed, resembling a stocking. Fist held in fundus, while external hand massages intervening portion of uterus, to stimulate contraction. Notice absence of cervical rim.

Fig. 5. In trying to locate the cervix, the examining fingers locate a small elevation at one point on the vaginal wall. By "kneading" outward from this point, along a circular course, a continuous soft ridge is made to appear.

Fig. 6. "Kneading" has stimulated the flaccid cervix to appear.

Williams quotes a case where inversion occurred in three successive deliveries.

Again I refer to hemorrhage, shock, and infection for the mortality is due to one or more of these three factors. According to Telfair[11] mortality is 36 per cent; Cooke[12] states 40 per cent; other authors quote between 15 and 70 per cent. DeLee[5] calls attention to Crosse, who in 1843 gathered 109 cases, and of these 80 died. Hypher[1] interestingly describes the cause of death in 2 cases treated by midwives; in one, the fundus was taken to be the placenta and it was pulled off with the adnexa; in the other, the uterus was thought to be a second child and it was pulled off.

Case Report. At 5:40 p.m. on December 24, 1934, Mrs. J. C., a white primipara, was seen in consultation at the Georgetown University Hospital. At 3:45 p.m., following a labor that was normal in all respects, she had delivered a baby weighing 7¾ pounds. The delivery had not been assisted by any pressure on the fundus. A second degree episiotomy had been repaired during the third stage of labor. After a third stage lasting fifteen minutes the placenta had been expressed by the Crede method. No definite hard mass could be felt when massaging the fundus and after rather vigorous massage pressure was exerted and the placenta appeared at the vulva, and was lifted out, for it showed no tendency to deliver itself. She was given 1 c.c. pituitrin and the massage was continued. A contracted fundus could not be felt and the patient bled moderately. At 5:15 p.m. a severe hemorrhage occurred and the patient was in shock; she was extremely pale and listless, rational and seemed to suffer no pain. I massaged vigorously over the normal location of the fundus, but could feel no evidence of it. After giving her 1 c.c. of gynergen

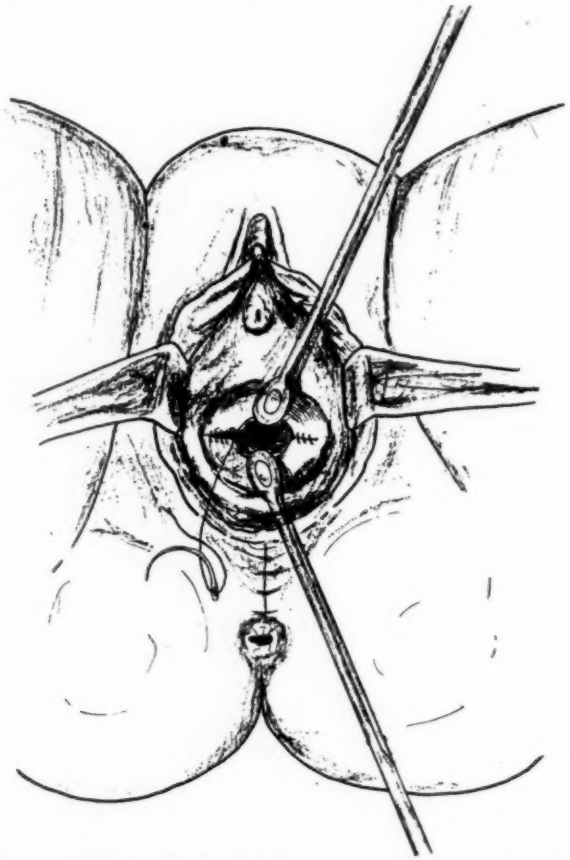

Fig. 7. Cervix brought into view and its lumen diminished to one-third of its size, in order to prevent recurrence when packing is removed.

subcutaneously and 2 c.c. of ergotole intramuscularly, I made pressure over the pelvic region and expressed four large clots about the

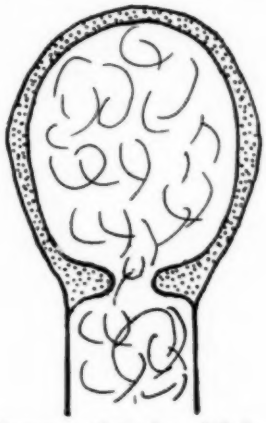

Fig. 8. Uterus and vagina tightly packed.

size of one's fist. At this time the patient's condition was very critical and the pulse not palpable. A transfusion was started and because of shock she was placed in lithotomy position with hips elevated, for uterine tamponade. More clots were removed from the vagina, and a spherical mass about the size of a grapefruit was palpable in midpelvis. (Fig. 1.) It felt very much like a clot, but because of its large size and symmetry, I separated the labia and inspected it. Recognizing the condition, I felt around the top of the mass in an effort to locate the cervix but could feel none. My intention was to reduce by taxis, pushing the upper portion through the cervix first and the lowermost portion last, as advocated by most authorities. This is logical, for in such manner the cervix would be expanded by as small a bulk as possible. Under surgical anesthesia and after hypodermic administration of adrenalin minims 10, this procedure was found to be ineffective, for besides being too hard, the mass was too large to be encircled by my hand. By making upward pressure from below, my external hand was able to feel the upper limit of the mass, with a distinct cupping into which I was able to place my fingers. Steadying the uterus in this manner, pressure was made on the most dependent portion with the tips of the middle and ring fingers. This was soon abandoned for the uterine musculature felt friable. By flexing these two fingers, upward pressure was safely made with the middle phalanges. (Fig. 2.) Suddenly a depression appeared (Fig. 3), into which the tips of several fingers could be placed, following by the entire fist, and gradually the inversion was reduced. The relaxed birth canal was extremely long and appeared like a dilated stocking. (Fig. 4.) The closed fist

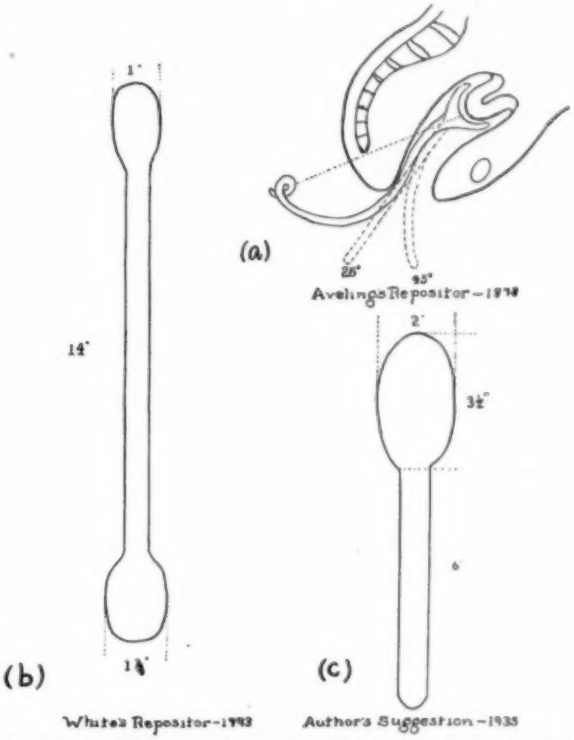

Fig. 9. (a) The repositor with which Aveling was able to reduce a chronic inversion. His model is an improvement on the two represented in dotted lines, since its force is supposedly applied perpendicular to the plane of the inlet. (b) White's repositor, for acute puerperal inversion. Either end may be applied to the lowermost portion of uterus and upward pressure made. (c) Author's suggestion for reduction of acute puerperal inversion by taxis. This device is made of wood and is ordinarily used for darning stockings.

was held in the uppermost portion for several minutes, while the external hand massaged the intervening portion of uterus in an attempt to stimulate contraction. There was no response. It was decided to pack the uterus, for any intra-abdominal pressure could have caused a recurrence. Usually in performing uterine tamponade, my left hand reaches the cervix and acts as a guide for the packing, which is inserted by my right hand with the aid of dressing forceps. Surprisingly, this could not be accomplished because of the unusual length of the birth canal. My intention now was to bring down the cervix, but it had relaxed to the extent that there was no demarcation between the uterus and the vagina. Finally, a small soft ridge was felt in the anterior vaginal wall

(Fig. 5); this was grasped and gently kneaded with the fingertips. Gradually more and more of this circular elevation could be outlined. (Fig. 6.) The anterior and posterior portions of the ridge were grasped with sponge forceps and brought into view. (Fig. 7.) The cervix was soft, about 3/8 inch thick and markedly dilated. Both sides were sutured with a continuous suture of No. 2 plain catgut, thus reducing the lumen to about one-third of its original size. To prevent partial prolapse and hemorrhage, six yards of gauze, thirty-six inches wide were placed in the uterus and two yards in the vagina. (Fig. 8.) Treatment for shock was instituted with improvement immediate in the appearance and the general condition, pulse was 140 and easily felt. Twenty-four hours later 1 c.c. pituitrin was given by hypodermic and packing removed. Recovery was uneventful.

In a reviewal of the literature I found only one case in which the cervix seemed to have disappeared, the case reported by John White[6] in Medical Commentaries in 1795 and to which reference has already been made. He, too, kneaded the vaginal wall with his fingers until he was able to feel a ridge of cervix, and then proceeded in the manner I have described. At the time that my fingertips began to perforate the uterine wall in attempting taxis, I visualized a simple devise here depicted (Fig. 9), which is ordinarily intended for darning stockings, and would have facilitated my attempt very much. Strangely enough, White in his report, suggests a similar apparatus (Fig. 9), namely a round stick of wood, 14 inches long, and expanded and padded at each end, to avoid trauma, one end measuring one inch in diameter and the other, 1¾ inches. Either end could be used for taxis.

From an analysis of the case presented, several deductions may be made.

1. Pressure should not be made on a fundus unless it is contracted.

2. If immediately after delivery the fundus is not palpable as a hard mass in its usual location, inversion should be suspected.

3. In any case of severe hemorrhage or shock after delivery, vaginal examination should be made.

4. In controlling postpartum hemorrhage by tamponade, do not pack the vagina only, but locate the cervix and pack the uterus. In this manner an existing inversion or a lacerated cervix would be discovered.

5. Extreme care should be exercised in removing clots from the vagina.

6. Shock appears to be relieved immediately after replacement; therefore cautious attempt at early reduction should be done.

7. Many cases probably go unrecognized. They are regarded as postpartum hemorrhage and if death occurs it is attributed to this cause. Otherwise the inversion may not be detected until it becomes chronic.

8. For this reason the incidence is probably greater than that reported in the literature.

9. The suggestion of diminishing the lumen of the cervix to prevent recurrence is presented as a contribution to the treatment of this condition.

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ACUTE DILATATION OF STOMACH

WITH REPORT OF A CASE*

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IT is the purpose of this paper to sketch briefly the concepts held regarding acute dilatation of the stomach, and to report and discuss a case of this kind, recently seen, which is unique in its etiology and offers many points of interest and instruction.

All surgeons of experience are familiar with acute gastric dilatation as a postoperative occurrence. It has been said that practically every abdominal operation involving extensive stimulation of visceral afferent nerves is followed by a degree of gastric relaxation. A considerable number of the reported cases followed operations under general anaesthesia, and a fair estimate would be that 60 to 70 per cent of the cases are postoperative in their origin. Acute gastric dilatation has also occurred following fractures, injuries to the spine and skull, blows to the abdomen, after catheterizing bladder or ureters, and complicating peritonitis. The German literature contains an unusual case which complicated a floating spleen.

In medicine it has been seen during convalescence from wasting diseases and has frequently complicated serious illnesses as pneumonia, typhoid, tuberculosis, diabetes and uremia. It has not been unusual to encounter it following difficult childbirth. Finally, it has been reported following excessive intake of food or drink in persons who were apparently in normal health.

Dragstedt has conducted a thoroughly scientific and very illuminating study into the pathology, physiology, and mechanics of this syndrome. His work represents probably the most valuable recent contribution to this subject.

The pathology in these cases is limited to the stomach which is tremendously dilated with gas or a mixture of gas and blackish colored fluid, and the transverse portion of the duodenum which is commonly found to be compressed at the point where the mesentery and superior mesenteric vessels cross it.

Physiologically the stomach is, like the heart, an automatic organ. In addition to its intrinsic nerve supply it receives fibers from the vagi which are predominantly motor to the stomach proper, but inhibitory to its sphincters; and fibers from the splanchnics which conversely are inhibitory to the stomach, but motor to its sphincters. A long chain of experimental evidence proves that stimulation of either splanchnic or somatic sensory nerves may produce inhibition of gastric tone through a reflex stimulation of the splanchnic, and inhibition of the vagus, nerves to the stomach.

The weight of evidence favors the theory that acute gastric dilatation is primarily of neurogenic origin. The factor of duodenal compression is quite clearly secondary, both in sequence and in importance, being produced most commonly by downward traction on the mesenteric root caused by the displacement of intestinal loops into the pelvis. Its significance in the syndrome however is real and lies in the fact that any obstruction to the intestinal channel, no matter how slight, probably offers a serious obstacle to an atonic, feeble stomach and duodenum.

Dragstedt's results in experiments on gastric and pancreatic secretion in dogs show clearly that our estimates for normal

* From the service of Dr. Wm. A. Behan.

secretion from these organs have probably been entirely too conservative, and that even under conditions of continued gastric stasis, such as are present in cases having prolonged gastric dilatation, the phenomenally large quantity of accumulating fluid is in reality but little more than that which is secreted into the upper alimentary tract under normal conditions. However, it is the inability of the atonic alimentary tract to transport these stomach and duodenal secretions into the absorbing lower portions of the intestinal tract, and the consequent continued loss to the blood of the ions sodium and chloride, which represent the major pathogenic factors in these cases of prolonged gastric dilatation.

CASE REPORT

This case of acute dilatation of the stomach falls within the group of 30 to 40 per cent which are termed non-postoperative in origin. It is a classical example of the condition and illustrates very graphically the mechanisms that are active in the early stage of gastric dilatation, before the secondary factors of fluid loss and blood chemistry change enter the picture. The etiology and clinical course of this unusual case appear to be without parallel in the literature.

B. The patient, a sixty year old housewife, was brought to the hospital by ambulance about 9:00 P.M. She was suffering most excruciating abdominal pain, and the history of her illness was obtained with great difficulty. It was learned that during the previous ten years she had been troubled by rather frequent attacks of abdominal distension, noticed soon after taking food, which would persist until she had raised gas. Belching relieved the ordinary attacks but occasionally she had found it necessary to induce vomiting in order to ease her stomach.

The morning of admission her bowel moved normally. A little later she noticed slight epigastric distress which became more pronounced by noon. She ate quite heavily and by three o'clock felt uncomfortable and bloated. Repeated attempts to belch gas failed to relieve her, and toward evening she noticed that her abdomen was definitely increasing in size. By this time the discomfort had become a constant with severe pain throughout the epigastrium. She tried to vomit but without success. At about 8:00 that evening she was found suffering intense pain, her abdomen tremendously distended and rigid. She was given about one grain of morphine sulphate hypodermically and was hospitalized immediately.

When seen at the hospital at 9:00 P.M. she was in a sitting position in bed, writhing from side to side and alternately moaning and screaming with pain. Temperature was 97.6°F., pulse 140, and respirations 28. The abdominal distension was greater than that of a full term pregnancy. The abdominal wall was tense and drum like and examination failed to reveal either palpable or auscultable peristalsis and was tympanitic throughout. Sharply demarcated at the level of the umbilicus, the entire lower half of her body was deeply cyanotic and cold. The perineum was bulging and the rectal mucosa had prolapsed from the tremendous intraabdominal pressure.

An attempt was made at once to pass a stomach tube but obstruction was encountered at the lower end of the esophagus and nothing was obtained. A soap suds enema was given without result. A second unsuccessful attempt was made to pass a stomach tube. The pain ostensibly was terrific and severe shock appeared imminent. It was decided to give morphine sulphate ¼ grain intravenously. The effect was profound. The screaming ceased almost immediately and within fifteen minutes respirations became so slow that continuous carbon dioxide-oxygen mixture and stimulants had to be administered in order to resuscitate her. In an hour her respiration was considered satisfactory. About 250 c.c. of 10 per cent dextrose solution were given intravenously and at midnight she was taken to the operating room in a quiet but not stuporous state, but with a very rapid and weak pulse.

Under spinal anaesthesia a right rectus exploratory incision was made. The abdominal wall was found to be very thin and relatively bloodless due to the tremendous distension. As the abdominal cavity was entered an extremely large, pale, tense structure was encountered which had the appearance of a huge cyst, but proved to be a greatly dilated stomach, extending from the ensiform cartilage

down to the pelvic brim. A trocar and cannula were inserted through its anterior wall in order to decompress it. An enormous amount of gas and a small amount of clear fluid were very gradually withdrawn through the cannula, care being taken to decompress the viscus slowly. The stomach was then identified as a large, atonic organ with numerous folds, very ischemic in appearance, but nowhere gangrenous. A small area of hemorrhage was found in the pre-pyloric region. The pylorus itself appeared definitely stenosed, and was the site of an old healed ulcer. The remainder of the bowel was normal. A hasty exploration failed to disclose any pathology of the other abdominal organs, and since the patient's condition was steadily growing worse, an enterostomy was performed quickly using a loop of jejunum. The abdomen was then closed in layers.

The patient was in deep shock at the conclusion of the procedure and died about twenty minutes later. Autopsy was performed eight hours post mortem. The more important points from the pathological report of Dr. Victor W. Bergstrom are quoted.

"The abdomen was markedly distended. The stomach and small bowel were tremendously dilated. The stomach appeared large enough to hold three or four quarts. The whole alimentary tract was considerably injected. There was no peritonitis—no free fluid. No inflammatory process could be found anywhere except in the lower border of the pancreas. In the tail were two areas of hemorrhage. One was about 1.5 cm. in diameter apparently involving the parenchyma, and another about 0.5 cm. in diameter. The gall bladder contained a large stone.

"The biliary tract was carefully examined. The pancreatic duct entered the common duct about 1½ cm. above the ampulla of Vater. All of the ducts appeared to be patent.

"The pylorus showed an old, healed ulcer in the serosa. On the mucosal surface of the ulcer no mucous membrane could be found. The pylorus could not be dilated more than to admit the tip of the little finger.

"Macroscopic Diagnosis—Hemorrhagic pancreatitis; Adynamic Ileus; Acute gastric distension; Old healed ulcer of pylorus.

"Microscopic examination of the pancreas shows very extensive areas of glandular necrosis with areas of interstitial hemorrhage. The condition is antemortem because the hemorrhage is old, having laid down quantities of blood pigment which are being phagocyted. There is slight perivascular and periductal, small, round cell infiltration. Blood vessels are sclerotic and some of them are completely occluded. Occlusion of blood vessels is noted very particularly in one of the necrotic areas.

"The pylorus shows an ulcer of not very great age. The base is not yet completely healed and is covered by a thin, organizing membrane. The gall bladder shows too much postmortem autolysis for pathological and histological changes to be identified.

"Microscopic Diagnosis—Acute pancreatic necrosis. Peptic ulcer of pylorus."

DISCUSSION

Considerable uncertainty was felt regarding the correct diagnosis in this case. Some thought that the perforation of a peptic ulcer might account for the clinical picture, others that the gall bladder might contain the underlying pathology. Only one man made an unequivocal diagnosis of acute pancreatitis.

More consideration should have been accorded the syndrome of acute pancreatitis. In the fulminating type it is very often attended by severe neurogenic shock such as this patient showed; cyanosis, rapid pulse, falling blood pressure, subnormal temperature, and collapse often being encountered. Moreover, agonizing and unremitting upper abdominal pain is perhaps the most typical single symptom of this disease.

It is purely conjectural to attempt to evaluate the importance which each factor in this case had in producing the acute dilatation of the stomach. That the old, partly healed pyloric ulcer had a definite part is more than likely, but alone it could not possibly have been responsible for the tremendous splanchnic shock which resulted in the profound loss of gastric motor function. It seems probable that the sequence of events was something as follows. The narrowing of the pylorus caused by the healing of the ulcer was so gradual in development that the compensa-

tory hypertrophy and increasing motility of the stomach were still successful in forcing gastric contents into the intestines. However, the rather frequent occurrence of epigastric distension, occasionally requiring vomiting for relief, indicates that at times the obstruction must have been quite marked. Very probably the onset of the attack of acute pancreatic necrosis inhibited gastric motor function so strongly through reflex splanchnic stimulation that the enfeebled peristalsis was no longer able to force gas and fluid through the pylorus. In belching to relieve her distress the patient swallowed air some of which became trapped in her stomach. Dilatation of the stomach began and increased steadily as more air was swallowed. It was inevitable that duodenal compression should occur. The distending stomach forced the small intestines down into the pelvis so that traction on the mesentery produced compression of the transverse duodenum in the manner that has been previously described.

Fluid and perhaps gas may have regurgitated from the small bowel into the stomach to add to the distension. However, gas in the quantity that was present in this case could only have accumulated so rapidly by being swallowed and retained in the stomach. This occurs not uncommonly during violent efforts to raise gas and to vomit. Whether our failure to pass the stomach tube was due to cardiospasm, which is one of the results of splanchnic stimulation, according to Dragstedt, or to an obstruction caused perhaps by a kinking of the lower esophagus incident to the tremendous dilatation of the stomach below it, unfortunately was not determined at autopsy.

SUMMARY

The common causes of the syndrome of acute dilatation of the stomach have been reviewed and its physiology briefly discussed.

A case of acute dilatation of the stomach has been presented which appeared to have a combined pancreatic and duodenal pathology as its main etiology.

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GANGRENE OF LUNG

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IN 1932 Israel reported a case of gangrene of the right lung in which he called particular attention to the extensiveness of the disease, stating that, "The postmortem, recorded below, describes a pulmonary gangrene that involved an entire lobe of a lung which I have been led to believe—judging from the paucity of published instances—is an extremely uncommon occurrence."[10]

We report here a case in which the entire lower lobe and half of the middle lobe of the right lung were liquified and passed by mouth over a period of three weeks dating from the onset of the condition until death.

True gangrene of the lung because of its rarity accounts in part for our incomplete understanding of the etiological and pathological types. A definite advance has been made in the therapeusis of localized pulmonary abscesses, but the mortality in actual gangrene of the lung is almost 100 per cent. The status of surgical accomplishments of the chest is now such, however, that a lowering of the mortality of pulmonary gangrene may perhaps be expected from surgical quarters providing criteria for early diagnosis and proper entity classification, may be successfully established.

A considerable amount of experimental work has been done upon the production of pulmonary suppurations. Kline and his coworkers, Lambert and Weeks,[13] and others deserve considerable credit for the efforts they have made in their etiological investigations. Kline feels that he has made some progress in the treatment of gangrenous suppurations by intravenous neoarsphenamine injections.[12] While the exact status of the frequency with which spirochetal organisms play in gangrene has not been as yet fully settled, it may be that these organisms are, at least in some instances, of considerable etiological importance. Fungi, it should also be remembered, may at times be either primary or secondary factors. Lambert and Weeks and others stress the potential importance of certain anaerobes.

Those predisposing factors such as emboli, upper respiratory injuries whether accidental or therapeutic, pulmonary disease and stasis, and factors relative to the patient's general well being, are fairly well known. The flat position for tonsillectomy, careful pre and postoperative attention to mouth hygiene, the consistent turning of the patient from side to side when permissible postoperatively, anesthesia carefully selected and given with good apparatus by an expert, are a few details which are neglected too often simply because complications resulting from a certain degree of their abuse are either minor or rare.

If an actual pulmonary gangrene is not rapidly checked or promptly started upon a course of localization by arsphenamine or massive iodide injections, radical surgery seems to be the treatment of choice providing there is no insurmountable contraindication.

In 1922, in a masterful article on lung surgery, Lilienthal stated that, "If operable pulmonary suppuration were as common as gangrenous appendicitis, surgeons would learn how to deal with it; and I may say by the same means, extirpation."[17] Babcock, considering gangrene of the lung, states "Recovery is rare without opera-

tion," and discusses briefly "pneumotomy and free drainage."

For the patient of this report, extensive surgery was considered early in the course, when the diagnosis of pulmonary gangrene was made. Had there been less concomitant pathology most probably partial or complete cautery extirpation of the gangrenous area, or extensive pneumotomy with valved drainage, would have been attempted. Besides the more extensive surgical measures we considered pneumothorax, pleural lavage, bronchoscopy, neosalvarsan therapy and antitoxin injections. These procedures were all discarded; in view of the excellent drainage which the patient seemed to be getting by mouth we decided to cast his lot with extreme conservatism feeling that some localization and immunity might possibly intervene.

Present Illness. C. V., age twenty-three, an electrician, was admitted to the Medical Arts Hospital at 2:45 A.M., April 10, 1935, following an automobile accident at 1 A.M. The patient, who was driving, was thrown from the car. Momentary unconsciousness was attained. He had not been drinking and all history otherwise was irrelevant or negative.

Physical Examination. The patient was almost perfect physically before his accident, weight 185, height 5 feet 11½ inches. On admittance, shock was moderate; blood pressure 100/80; pulse 96; respiration 18. Morphine and first aid had been administered before admittance. He was conscious and cooperative.

Head and face injuries constituted a 3 inch laceration of the scalp down to the skull in the right frontal area, contusion and swelling of the entire face; a complete transverse fracture of the left ramus of the mandible and a comminuted fracture of the mandible in the region of the right mental foramen. Very little injury to the soft parts of the mouth or the teeth was present. A break in the continuity of the gums with mild secondary infection developed at the area of the latter fracture. No discolorations, tender areas, or pathological signs or symptoms of the soft or bony parts of the chest could be elicited by clinical and roentgenological examination, with the exception of a slight general tenderness around the lower lateral part of the right chest. In its upper third the right leg presented a severe compound comminuted fracture of the tibia and fibula involving 4 inches of the bones and soft tissues. The right fibula also presented a transverse comminuted fracture in it's lower third. Considerable venous hemorrhage was prone to occur from the leg wound. Except for minor contusions and lacerations, the rest of the examination was negative.

April 10, 1935, 9:00 A.M., permanent control of hemorrhage, debridement of the leg wound with open reduction of the upper leg fractures, placement of wires for the mandibular fractures, suture of the scalp and minor dressings were done. The mandibular wires were not tightened until later for fear of possible aspiration of vomitus. Gas, oxygen and ether anesthesia was administered and the lungs were thoroughly washed with oxygen and carbon dioxide on completion. The post operative condition was good. The patient was shifted through a 22⅓° angle from side to side every hour for the first six hours and every one and one-half hours the following six hours, and occasionally thereafter. April 12, 1935, 4:10 P.M., for first time he complained of rather severe aching pain in the right kidney region. April 13, 1935, 9:00 A.M., temperature 101.6°; pulse rate 112; respiration 24; general appearance good. April 16, 1935, complaining of sharp pain in right chest and back and some nonproductive cough. At 8:00 P.M. the axillary temperature was 104°; respiration 28; pulse 112; some moderate dimunition of the breath sounds at the right base. These were the first definitely abnormal objective chest findings. April 21, 1935, cough became increased with offensive breath. At 11:25 P.M., he began to cough hard with offensive odor; raised and swallowed some production. Breath sounds were much decreased at the right base, with a few crepitant rales heard. April 22, 1935, at 1:00 A.M., increasing dosages of narcotic became necessary to control spasmodic cough. The stench of the breath was more marked. His general appearance was fair. The diagnosis was made of suppurating gangrenous pocket with infection of possible fulminating nature. Blood count at 2:00 A.M. showed a total white count of 20,300 cells; polymorphonuclears 91 per cent; segmented 67 per cent; stabs 21; juveniles 2; lymphocytes 8 per cent; basophiles 1 per cent; monocytes 1. There was no eosinophiles,

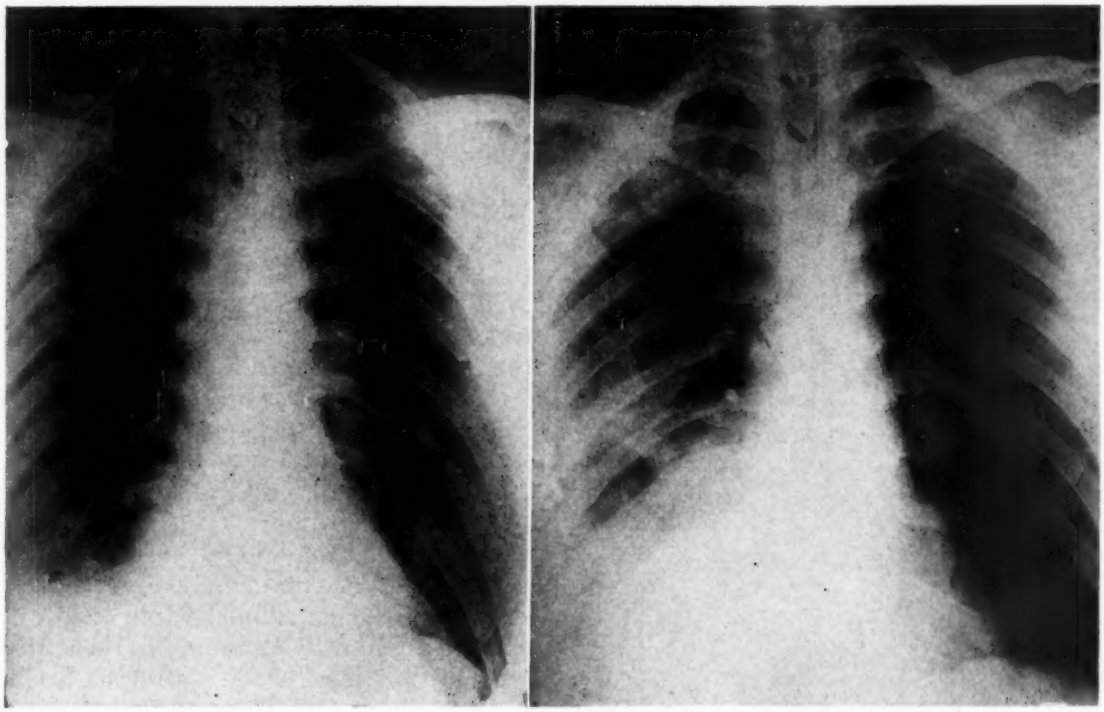

FIG. 1*a*.

FIG. 1*b*.

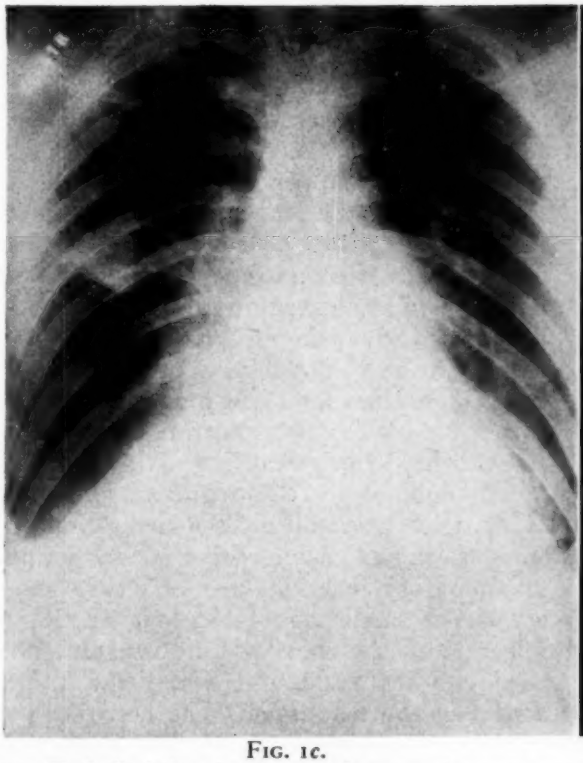

FIG. 1*c*.

FIG. 1*d*.

FIG. 1. Embolic infarction from a fracture site was promptly considered as the possible etiological factor in the developing pulmonary condition. We believe however, that the etiological factor was an aspiration affair. It should be noted that the orthodontist had considerable trouble keeping the mandibular fractures properly immobilized.

The plates were taken on the following dates: (*a*) April 12; (*b*) April 17; (*c*) April 29; (*d*) May 6, 1935.

myelocytes or normoblasts. Roentgenological and other opinions varied regarding the degree and type of pulmonary infection. Dr. Edgar

Fig. 2. The lower lobe and the anterior half of the middle lobe of the right lung had been liquified and passed by mouth. The depression shown in the upper lobe was caused by pressure used in preservation of the specimen.

McPeak suggested heavy doses of iodides in consideration of possible fungus invasion. The possibilities and accomplishments which radical surgery offered were considered, but conservatism with intravenous iodide injections was instituted.

April 23, 1935, the breath sounds were practically absent over anterior right base, otherwise the chest findings were essentially negative. On general appearance he seemed to be holding up well. He was raising and swallowing large amounts of sputum. April 30, 1935, 11:00 A.M., the blood count showed total white cells 8,400; polyphocytes 83 per cent; segmented 31 per cent; stabs 27; juveniles 5 per cent; lymphocytes 13 per cent; monocytes 2 per cent; myelocytes 2 per cent; no eosinophiles, basophiles or normoblasts. At 8:00 P.M., his temperature was 100.6, pulse 84, fairly strong and regular; respiration 22; and general appearance fair. May 6, 1935, he appears emotionally depressed and is expecting death. Fully rational, cooperative, pulse strong and regular. Chest aspirated; 60 c.c. of thin odorifirous pus obtained. In cases of this type the danger of cellulitis has been mentioned repeatedly. There was a definite variance of opinions among the consultants as to its advisibility in this case. May 8, 1935, brawny swelling developing from right axilla to below crest of ileum. May 10, 1935, from 8:00 P.M. to 4:15 A.M., morphine gr. 5.5 with 2 HMC's, did not effectively control cough. He was fully conscious almost until the immediate time of exodus, fully cognizant for hours of approaching death. The racking cough which persisted for days was the single subject of his pitiful complaint.

Laboratory Findings: It is not essential to report all blood counts, transfusions and urine analyses which were done. Some difficulty was experienced in obtaining sputum specimens because of the mandibular wiring. Most of the sputum raised was swallowed. In the specimens studied no spirochetes, fusiform bacilli or fungi were seen. Culture by Dr. R. E. Scott on Sabourraud's media showed no fungi. Smear showed pus cells, lymphocytes, a few pneumococci like organisms, short chained streptococci, and several clumps of staphylococci. Cultures directly from the involved lung at autopsy showed a very small feebly hemolytic staphylococcus albus. (Dr. Scott.)

Autopsy: The upper right lobe and the portion of the middle lobe remaining, except for the immediate area of the advancing gangrenous process, were grossly negative. The left lung showed some scattered areas of congestion. The line of advancing gangrenous involvement seemed to be confined to a margin less than 0.5 cm. in thickness; the lung tissue beyond this thickness was not infiltrated but the lung tissue behind this advancing margin was completely liquified and disintegrated. The interior of the right chest wall and the mediastinal chest surface were extensively involved in fibrinous, inflammatory reaction. Bits of pleura and an occasional small tag of old lung tissue were adherent to the chest wall and diaphragm. A thick fibrous exudate covered the thoracic aspect of the diaphragm. The hepatic side of this structure was absolutely free from inflammatory reaction. About 500 c.c. of thin pus was present in the chest cavity, apparently the result of the physiological terminal stage. The entire lower lobe and half of the middle lobe of the right lung had been destroyed by an

odorifirous, gangrenous process. There was a thick brawny swelling involving the skin and tissues of the right chest wall from below the crest of the ileum to and including the right axilla. The leg fracture sites presented no evidence of any infection. Moderate infection was evident at the site of the right jaw fracture.

SUMMARY

1. The rarity of pulmonary gangrene accounts partly for our incomplete understanding of etiological and pathological types. All cases should be reported in detail in order that improvement in classification and treatment may continue.

2. The mortality in spreading gangrene of the lung is practically 100 per cent. With our present limitations, extirpation, probably of the cautery type, seems promptly indicated if the condition does not respond rapidly to neosalvarsan or massive iodide therapy.

3. Uncontrollable cough produced pitiful and prolonged suffering in our case. Marked stench of the breath, a good general appearance of the patient long after the blood picture became very alarming and roentgenological findings, were other interesting features.

Drs. John A. Rowe and Franz W. Stumpf handled the orthodontia procedures in this case.

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VOLUNTARY DISLOCATION OF NECK

UNILATERAL ROTATORY SUBLUXATION OF THE ATLAS

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SPORADIC reports of unilateral rotatory dislocation and subluxation of the atlas have appeared in the medical literature since the latter part of the Eighteenth Century. The condition is characterized by a forward and medial displacement of one articulating facet of the atlas upon the corresponding facet of the axis around the odontoid process, the opposite atlanto-axial joint remaining within the limits of normal apposition. The displacement may be either partial or complete but is rarely associated with neurologic manifestations. Malgaigne,[1] in 1855, described the condition in detail, noting the incidence of two separate etiologic factors, namely trauma and tuberculosis of the atlas or axis. Walton,[2] in 1892, reviewed a series of cases of rotatory dislocation of the atlas without paralysis, demonstrating that the unilateral character of the displacement minimized the possibility of injury to the spinal cord. Corner,[3] in 1907, gave considerable impetus to the study of this previously little recognized condition when he analyzed 20 cases, including 2 of his own, and explained the mechanism of rotatory displacement of the atlas. Since that time similar cases have been reported by Mixter and Osgood,[4] Ogilvy,[5] Ranzi and Vogl,[6] Jackson,[7] Langworthy,[8] Greeley,[9] Coutts,[10] Brookes,[11] Hudson[12] and others. Increasing recognition of the condition is attested by the frequency of these reports within the past few years.

In each reported instance of atlanto-axial displacement, the condition has been accidental, the result of trauma, disease or congenital malformation. The writer has recently observed a case in which the displacement was entirely under the control of the patient, a voluntary unilateral rotatory subluxation of the atlas on the axis. Because of its unusual nature and its medico-legal possibilities, this case is considered sufficiently important to record herewith.

ANATOMIC CONSIDERATIONS

The odontoid process of the axis projects upward through the ring of the atlas. It articulates with the anterior arch of the atlas in front by means of a true joint, and is bounded on either side by the lateral masses of the atlas and posteriorly by the strong transverse ligament. The atlanto-axial joints, permitting normal rotation of the atlas around the odontoid process, are located on the inferior surfaces of the lateral masses of the atlas and on the superior surface of the body of the axis. The facets of the atlas look downward and inward while those of the axis look upward and outward. The joint surfaces are nearly plane, but there is a slight convexity of the facets of the atlas and a corresponding cancavity of the axial facets. This anatomical structure predisposes to joint instability. In addition to the transverse ligament which bridges the atlas between the odontoid process and the spinal canal, the anterior and posterior atlanto-axial ligaments, the lateral and median check ligaments between the odontoid process and the occiput, and the capsular ligaments assist in maintaining the integrity of the atlanto-axial joints. While there is a definite rocker action at the atlanto-axial joints, the function of these joints is chiefly rotatory. This necessitates a laxity of the joint capsules in order to permit normal motion. Therefore, despite the powerful ligamentous support in the atlanto-axial region, a large part of the burden of resistance to excessive rotatory strains is thrust upon the muscles of the neck. Severe

trauma may prove too much for these muscles and rotatory dislocation with or without fracture may result. On the other hand, very mild trauma, if applied suddenly, may catch these muscles "off guard" so that no protection is afforded the relaxed capsules and rotatory dislocation ensues. Furthermore, any congenital abnormality or pathologic state affecting either the joint structures themselves or the balance of the cervical musculature may give rise to atlanto-axial displacement.

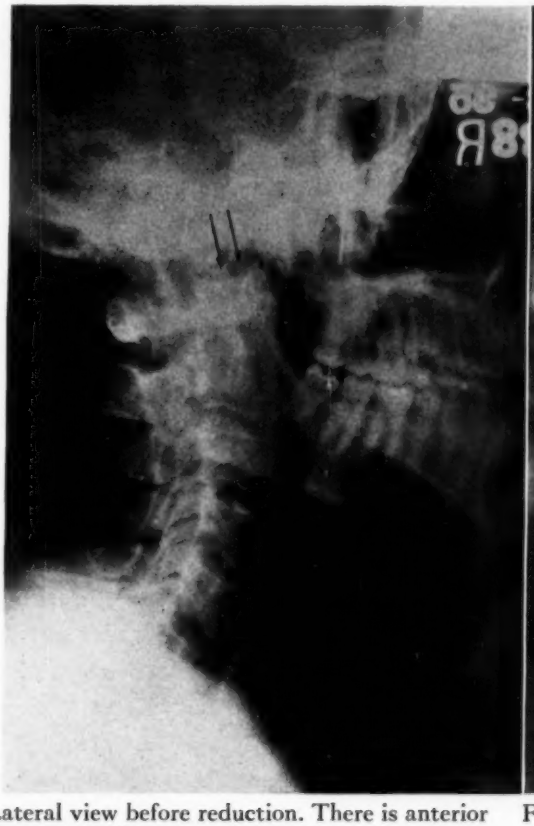

Fig. 1. Lateral view before reduction. There is anterior displacement of the atlas on the axis as determined by the line method of George and Leonard. There is some lateral tilting of the atlas. The arrows show the amount of odonto-atlantial displacement. Courtesy of Dr. Wendell Stewart.

Fig. 2. Semilateral view showing separation between the anterior arch of the atlas and the odontoid process. This separation could not be reproduced on the film in the case of another patient whose head was held flexed, tilted and rotated to the left within normal limits.

ETIOLOGIC FACTORS

The clinical and roentgenologic manifestations of unilateral rotatory displacement of the atlas are beyond the scope of this brief review. Excellent descriptions in the more recent communications, notably those of Coutts, Jackson, Langworthy, and Brookes adequately cover this phase of the subject. The etiologic factors heretofore reported may, however, be summarized.

Direct trauma to either side of the head is the commonest cause. Severe trauma is often associated with fracture, usually of the odontoid process. Brookes believes that alcoholism and the general toxic state associated with the prodromes of acute diseases are predisposing factors to dislocation by mild trauma. Blaine[13] and others have reported the occurrence of the condition following chiropractic manipulation. Over-correction of the deformity of torticollis has occasionally been the cause.

Indirect trauma, often of surprising mildness, has played a prominent part in the etiology of the cases reported by most writers. Thus, a sudden twist of the neck to respond to a greeting or to catch a ball has resulted in unilateral rotatory dislocation of the atlas. Yawning has been known

to produce it, and there are reports of its occurrence during sleep and during the convulsions of epilepsy or the tonic spasms of tetanus.

Fig. 3. Antero-posterior view showing elevation of the right lateral mass of the atlas and slight increase in the right atlanto-axial joint space.

Fig. 4. Lateral view after reduction. There is no evidence of fracture or anomalous bone formation. There is normal alinement of the cervical spine. The odontoid process and the anterior arch of the atlas are in normal apposition.

Many of the earlier writers noted *spontaneous displacements* of the atlas due to bone disease, especially tuberculosis. Ely,[14] Rimbaud,[15] and Stammers and Frazer[16] have reported the condition as occurring during the course of chronic infectious arthritis. The latter observers believed it could be ascribed to distention of the bursa between the odontoid process and the transverse ligament with subsequent weakening of the latter structure. Muscular weakness as seen in infantile paralysis has been held responsible in some cases. Swanberg,[17] Barnett,[18] and Sudeck[19] have reported the condition following the relaxation of anesthesia. Congenital anomalies of the atlas or axis, luetic osteitis, osteomyelitis and metastatic malignancy have been noted as causes of spontaneous dislocation.

Dislocations of the atlas *during or following acute infectious diseases* have been noted by Mouriquand, Sédallian and Savoye,[20] by Jacobs[21] and by Berkheiser and Seidler.[22] The latter observers feel that in these cases there is a localization of the infection either in the capsules of the atlanto-axial joints or in the odontoid bursa, causing distention, relaxation and displacement. General weakness of the neck muscles during acute illness may be the basic factor.

Spontaneous *hyperemic dislocations* have been reported by Woltman and Meyerding,[23] Fitzwilliams,[24] A. R. Jones[25] and R. W. Jones.[26] The latter observer states that in 1833 Benjamin Bell described such a case following a deep ulcer in the back

of the neck which "destroyed the transverse ligament of the atlas." Jones believes that any infection which causes hyperemia at the base of the skull may predispose to displacement of the atlanto-axial joints. Such infections include tonsillitis, pharyngitis, otitis media, mastoiditis, cervical adenitis, and retropharyngeal abscess. Jones feels that direct association between the infection and the atlas is unnecessary and believes the displacement is due to a hyperemic decalcification of the atlas at the point of attachment of the transverse ligament with subsequent relaxation. Protective cervical muscle spasm is probably an important element in the production of this type of dislocation.

CASE REPORT

J. C., a white male, age twenty-nine, a photographer, was admitted to the Accident Ward of the Jewish Hospital at 3 P.M., December 25, 1934. The patient walked into the hospital with the assistance of a "younger brother." The latter stated that fifteen minutes previously the patient had fallen down the upper steps of a double-deck bus, striking the right side of his head. He was unconscious for about two minutes and was then brought to the hospital in a taxicab. When first seen the patient was supporting his chin with both hands. The neck was flexed on the chest and the head was tilted and rotated to the left. The patient complained of severe pain in the back of the neck, and slight pain in the right temporal region and the left shoulder. He complained of pain upon the slightest motion of the neck and refused to assume the recumbent position. Examination revealed tenderness over the upper cervical vertebra in the midline and to the right side. There was spasm of the muscles to the right of the midline in the cervical region and of the right sternocleidomastoid. The patient was perfectly rational, but extremely apprehensive, the face bearing an expression of genuine anxiety. The skin was cool and moist and there was mild but definite cyanosis. The blood pressure was 140 mms. systolic and 78 mms. diastolic. The temperature was 98.6°F., the pulse 92 and respiration 16. The patient coughed occasionally and expectorated a thin, slightly reddish sputum. There was no evidence of injury to the lips, mouth or pharynx. The patient belched frequently but there was apparently no difficulty in respiration. No sign of injury to the right side of the head was found and the examination of the left shoulder was entirely negative. There was no demonstrable muscular weakness or sensory change in the upper or lower extremities although the patient stated there was a feeling of numbness in the left arm and hand. Both patellar reflexes were moderately exaggerated.

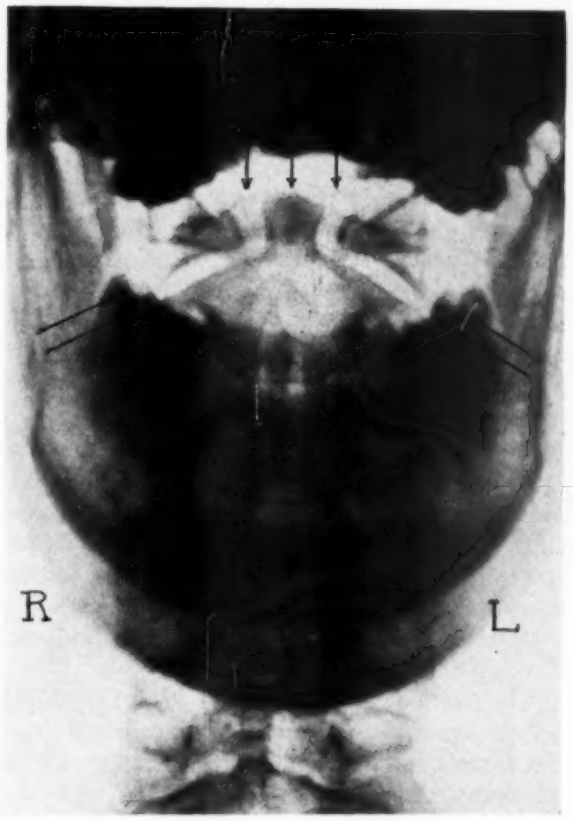

Fig. 5. Antero-posterior view through the mouth after reduction. The atlanto-axial relationship is normal.

Roentgenologic examination (Figs. 1, 2 and 3) revealed a rotatory subluxation of the right atlanto-axial joint. The anterior arch of the atlas was distinctly anterior to its normal position in relation to the body of the axis. The odontoid process was definitely posterior to its normal point of articulation with the anterior arch. A view through the open mouth was impossible to obtain because of the tilt of the head and inability of the patient to open his jaws. An antero-posterior film disclosed elevation of the right side of the atlas and widening of the atlanto-axial joint on the right.

Although the patient complained of severe pain, he refused all narcotics. An early attempt at reduction of the deformity was attempted by the resident, but was unsuccessful because of pain and muscle spasm. The patient was informed that reduction under an anesthetic was required. This was refused and only after considerable persuasion was written consent for the manipulation given. The deformity was easily reduced without anesthesia by the method of Walton, the head being further tilted to the left, then rotated under traction to the midline and hyperextended, counter traction being made on the shoulders. Following reduction, the patient still complained of pain, and the cyanosis persisted for several minutes. Roentgenograms taken at that time revealed a normal alignment of the atlas and axis (Figs. 4 and 5). The patient was placed in bed, ten pounds of weight were applied to the head by means of a leather harness and the head of the bed was elevated. The patient was informed that after several days' traction a plaster mould of the neck was to be made and a collar fitted.

The patient was difficult to manage. He complained of the head traction but refused sedatives. Twelve hours after the injury the temperature had gradually risen to 103°F. and the pulse to 112. The following day the temperature varied between 99.6°F. and 101°F. and the pulse between 98 and 108. The respiratory rate did not exceed normal limits. The Wassermann test was negative. The urine, blood count and blood chemistry were normal. The patient still complained of severe pain in the neck and of numbness of the left arm and hand. On one occasion he removed the head traction and sat upright in bed.

On the second day the temperature, pulse and respirations were entirely normal and there was no further increase at any time during his stay in the hospital. The patient was more comfortable, but again removed the head traction, despite warnings against the possibility of recurrence of the deformity. On the afternoon of the third day the patient became entirely unmanageable. He began to whimper and shake, complaining of numbness of the hands and a "floating feeling." That evening he stated he could stand the traction no longer, unfastened it, got out of bed and dressed himself. By creating a terrific disturbance at the hospital, the patient made a forced departure after signing a release.

Investigation revealed that the bus company had made a cash settlement with the patient a few hours prior to his hurried exit. A search of the hotel room which had been given as the patient's temporary address disclosed two empty suitcases. A nation-wide inquiry into the patient's identity was soon rewarded by a California police record, checked by actual photograph. This man had made numerous fraudulent claims throughout the country, simulating injuries while a passenger on public carriers. In no previous instance was there an alleged injury to the neck. Various Index Bureaus, having in their files the activities of similar swindlers, had no record of anyone with this particular amazing talent. The medical literature contained no parallel case. Other transportation companies had had no such experience. Meanwhile the patient had completely disappeared.

In March, 1935, a claim was made against a traction company for injuries sustained to the wrist by a man in Pittsburgh. The claimant attracted suspicion because of his anxiety for rapid settlement, but escaped before he could be arrested. Photographic check revealed him to be the person sought in Philadelphia.

In May, 1935 the patient appeared at St. Mary's Hospital, East St. Louis, Ill., having supposedly fallen down the steps of a bus in that city. He complained of severe pain in the neck and was somewhat cyanotic. The head was tilted and rotated to the left. The patient simulated paralysis of the left arm and leg and there was partial analgesia of these extremities. The left patellar reflex was exaggerated. Roentgenograms taken by Dr. Wendell Stewart revealed anterior rotatory subluxation of the right atlanto-axial joint. While the patient was being transfered to bed for reduction of the deformity by head traction, he gave a sudden cry, there was increased cyanosis and the head returned spontaneously or was returned voluntarily to normal position. Subsequent roentgenograms verified the reduction of the subluxation. After several days in bed, settlement was made by the bus company and this was followed by complete subsidence of symptoms and the patient's departure. The prompt recovery upon payment, however, and the widespread publicity of the Philadelphia investigation led to the patient's arrest as he was leaving the hospital. He pleaded guilty to

a charge of obtaining money under false pretenses and was sentenced to five weeks' imprisonment.

COMMENT

The medico-legal importance of this additional etiologic factor in unilateral rotatory subluxation of the atlas is self-evident. It is a well known fact that certain persons have the peculiar ability to partially or completely dislocate one or more of the larger joints, especially the hip and shoulder. Others, by muscular action, produce changes in surface contour simulating dislocation. Philadelphia anatomists know of no such voluntary control over the joints of the cervical spine. An extensive search of the literature has revealed no similar case. The basis for this voluntary control of the atlanto-axial joint must rest upon one of two possibilities. Anomalous development of the atlanto-axial region may have produced an unusual laxity of the capsule and surrounding ligaments; or previous actual traumatic, spontaneous, infectious or hyperemic dislocation may have occurred with residual laxity. It is hardly reasonable to believe that with normal atlanto-axial joints sufficient voluntary muscular control could be developed to produce displacement.

Roentgenograms show no abnormality of the bony structures, and the patient is loathe to discuss his previous history or the detailed mechanism of his prowess. It is hoped that this report will serve as a reminder of the astonishing ability of certain talented individuals to produce or simulate dislocations of various joint structures. Unilateral rotatory subluxation of the atlanto-axial articulation has been shown to come well within the range of their repertoire.

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ABERRANT LINGUAL THYROID

REPORT OF A CASE*

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B. S., male, age thirty years, was admitted to the hospital on January 16th, 1933, with a five year history of a gradually increasing lump on the back of his tongue which interfered with deglutition. Only liquids and semi-solids could be swallowed, and this was occasionally followed by choking and coughing. His speech was impaired, his voice being thick and non-resonant. During this period he had gained about thirty pounds in weight.

Examination revealed a male adult presenting all the signs of myxedema, such as sluggish mentality, swollen face, thickened lips and eyelids, edema of the hands and feet, loss of hair, dryness and roughness of the skin. No evidence of a thyroid gland could be found upon examination of the lower part of the neck. The trachea could be readily palpated. The tongue presented a large, firm, solid dull red mass, posteriorly in the midline, extending to the entire undersurface of the tongue above the hyoid bone.

Mirror examination showed this mass extended downward and backward toward the pharyngeal wall obscuring the view of the epiglottis and the remainder of the larynx. Direct laryngoscopy demonstrated that the tumor mass was central and attached to the posterior surface of the tongue, with many large veins seen traversing it. It was impossible to elevate the tongue with the tip of the laryngoscope, so that a view of the larynx was unobtainable. A small piece of tissue was removed for biopsy. This was followed by a severe hemorrhage which was finally controlled by the electric cautery.

Lateral *x*-ray picture of the neck revealed a large mass extending downward from the tongue into the pharynx, depressing the epiglottis and narrowing the lumen of the oropharynx. The tumefaction reached into the sublingual region and appeared to be pushing the hyoid bone downward.

The basal metabolic rate on admission was minus 26. Under thyroid therapy this rose and became normal, and the symptoms of myxedema disappeared within two weeks. The patient became more alert mentally, the edema of the face and legs was no longer present while the skin became smooth and moist.

The *x*-ray study (Fig. 1) would indicate that the patient had both a lingual and a sublingual thyroid tumor. Although this mass was causing difficulty in swallowing, it was felt that surgery should not be done, because of the myxedma. Even if this were not so, the severe hemorrhage that followed attempted removal of the lingual thyroid tissue, might be repeated and endangered the patient's life. In addition, no thyroid tissue could be detected in the neck. Unfortunately, the biopsy specimen was lost. However, it was felt that we were dealing with some form of degeneration of the thyroid tissue, which originally made up the mass.

Of the aberrant tumors of the thyroid, those in the lingual region are probably the rarest. In 7600 cases of thyroid disease at the Lahey Clinic only 2 were encountered and only 2 in 4000 cases at the University of Pennsylvania. Lingual thyroids can cause asphyxia in the newborn, troublesome hemorrhage, myxedema and on rare occasion may be the seat of carcinoma. Approximately 150 cases have been reported in the literature. This condition occurs about eight times as often in males as in females. The average age is thirty years.

What was probably the first case of lingual thyroid was described by Hickman[9] in 1869. His patient was a newborn infant who appeared to be asphyxiated, and palpation revealed a mass filling the oral cavity. Death occurred before a life-saving tracheotomy could be done. Postmortem examination revealed a lingual goitre com-

* From the Otolaryngological Service of Dr. Louis C. Menger, Bushwick Hospital.

pletely filling the pharynx. Meixner[15] reported a case in which the child never breathed, postmortem examination revealed a large growth pressing upon the epiglottis. Perkins,[21] quoting Aschoff, reported the case of a six months old infant, who died of myxedema, in which a lingual thyroid was found at postmortem.

New's[18] patient was probably the youngest in the literature. A male infant of three and one-half months had had difficulty in breathing and swallowing since he was two weeks old, because of a mass on the dorsum of the tongue. New has seen 10 cases, probably the largest number observed by any individual. In none of his cases was the mass large enough to cause alarming symptoms so no treatment was required.

Bernays[2] in 1888, described the first operated case of lingual thyroid. The patient, a girl of seventeen years, had both a sublingual and a lingual thyroid. Both tumors were removed by means of an incision extending from the inferior maxilla to the hyoid bone, which divided all the structures down to the tumor.

Spontaneous hemorrhage from the large vessels coursing across the tumor is nto uncommon. According to Grace and Weeks[6] this occurred in 8 of the 81 cases which Dore collected. Hemorrhage is frequently encountered when tissue removal for biopsy is done. This occurred in the writer's case.

Rabinowitz[23] reported a case in a female, age forty-seven years, who for four months had a mass on the posterior surface of the tongue which occupied almost the entire thickness of the tongue and extended well into the suprahyoid region. Following a section for biopsy severe bleeding occurred which required several mattress sutures for its control. The tumor was not removed because of the hemorrhage and the presence of myxedema. There were no symptoms of pharyngeal or laryngeal obstruction and no thyroid tissue was to be found in the neck.

Pearlman[20] and Porter[22] described hemorrhage as a symptom. Monroe and Taylor's[17] patient had symptoms of myxedema in which the tumor was removed because of attacks of bleeding and difficulty in swallowing. Smythe[24] reported an interesting case in a female of seventy-nine years, who choked while eating canned corn. Her son attempted to remove the foreign body with his finger and caused a severe hemorrhage. Kramer's[11] patient suffered with occasional profuse, hemorrhages from the mouth over a period of ten years. Her basal metabolic rate before operation was normal. Ten days after removal of the tumor she showed signs of myxedema.

Fig. 1. Lateral roentgenogram showing irregular tumor mass at the tongue base and large rounded tumor mass filling sublingual region.

Two cases of a lingual thyroid attached by a pedicle have been described. Bishop[3] reported a case in which the lingual thyroid was connected to the base of the tongue by a pedicle and was removed under local anesthesia with a tonsil snare. Harvey[7] had a similar experience with a female of twenty-six years, who was a cretin and looked like a child of eight years. She had no palpable thyroid tissue in the neck. The

growth was removed because of severe hemorrhages, dyspnoea and dysphagia.

Myxedema is frequently encountered in lingual thyroids. A basal metabolism should always be done in this condition before contemplating any operative procedure. The percentage of cases of myxedema occurring after operations on the lingual thyroid, has been estimated by various authors to range from 15 to more than 50 per cent. In the absence of other demonstrable thyroid tissue, complete removal of the lingual thyroid is definitely contraindicated. The frequency of myxedema is relatively great following its removal. The experiences of Lahey,[12] Miller,[16] Ziegelman,[26] Bisi,[4] Cattell and Hoover,[5] Harvey,[7] Haynes,[8] Lenzi,[13] and Kramer[11] prove this to be so.

Cattell and Hoover[5] report the case of a woman of sixty-two years, who had a growth on the tongue for forty years. She developed small masses in the skin of her back and which later became scattered over her body. The thyroid gland could not be palpated. At postmortem it was thought that death resulted from melanosarcoma with widespread metastases. Microscopic examination however showed that these growths were leukemic nodules. Similar deposits were found in the trachea, lymph nodes and other organs.

Lahey[12] reported a female of twenty-five years, who had had a tumor at the base of the tongue since birth. Her basal metabolism before operation was normal. Twelve days after operation it was minus 18. After two months thyroid extract medication it became plus 19. Lenzi[13] reported a case in which myxedema developed following the removal of a tumor in the submaxillary region and another at the base of the tongue. Examination showed both tumors to contain thyroid tissue. Hill[10] reported a case in a Negress, nine years old, who had a lump on the tongue for three years. No thyroid could be felt in the neck. Goiters were present in both the mother and grandmother.

Whalen[25] reported a case in a female of twenty-four years, in which the size of the lingual thyroid was reduced by puncture with the endothermy electrode without developing symptoms of myxedema. Ziegelman[26] states that St. Clair Thomson was the first to suggest the use of electrocoagulation in the treatment of lingual goitre.

Owens[19] describes the case of a female of thirty-six years who did not develop myxedema nine months after removal of a lingual tumor. Although he could not find any thyroid in the neck, he felt that she probably had thyroid tissue elsewhere.

Carcinoma occurring in a lingual thyroid is a rarity, only 2 cases having been reported in the literature. Ashhurst and White[1] report the case of a male, fifty-six years of age, who had a lump on the back of his tongue for more than twenty years. Five years after this was first noticed, he began to complain of pain. The mass was considered as lingual tonsil tissue and therefore removed. Bilaterally enlarged glands of the neck appeared, three years after operation. The tongue growth gradually returned. The mass was hard and slightly ulcerated, and was removed with the electric cautery knife, under intratracheal ether anesthesia. This proved to be adenocarcinoma of a lingual thyroid.

Levi and Hankins[14] reported the second case in a female of twenty-one years, who had a mass on the posterior portion of the tongue. Swallowing produced pain, choking and coughing. A small mass in the region of the posterior surface of the tongue, was removed by actual cautery under ether anesthesia. Biopsy revealed a low grade carcinoma arising in the thyroid tissue. She developed an edema of the larynx on the second day following operation which necessitated a tracheotomy. The tube was removed two weeks later.

CONCLUSIONS

One must always bear in mind the possibility of the presence of an aberrant thyroid tumor on the posterior dorsum of the tongue. The diagnosis is established

when no thyroid tissue is detectable in the neck and unusual vascularity is noted. The usual picture presented is that of a smooth, rounded mass in the preepiglottic region with relatively large blood vessels traversing its surface. Sectioning for biopsy may mean severe, and at times, seriously troublesome hemorrhage. Also the thyroid tissue at the tongue base may be all that the patient possesses, so that its removal will cause myxedema and necessitate taking thyroid extract for the remainder of one's life.

Carcinoma of the lingual thyroid is unusually rare.

SUMMARY

A case is reported in which a patient had an extensive tumor in both the lingual and sublingual regions, with myxedema as the predominant picture. The condition cleared after the administration of thyroid extract. The importance of knowing the patient's metabolic rate is stressed. The hemorrhage incidental to biopsy was so severe as to require electrocautery for its control.

The value of *x*-ray films in the lateral plane of the tongue base region, is demonstrated.

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INTRASCROTAL LIPOMA

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BROOKLYN, N. Y.

IT is difficult to determine the frequence of a solid mass of fat within the scrotum, but the number reported is small, though interesting because of the diagnostic difficulties associated with them. Textbooks on urology merely mention them under the general heading of scrotal tumors.

The majority of fatty tumors recorded in the literature, evidently originated from the structures in close relation to the scrotal walls rather than from the tissues which comprise the walls. For instance, either arising from the fat in the spermatic cord or from the preperitoneal fat which descended through the inguinal canal into the scrotum. In some cases, like one reported by Cecil, it is almost impossible to surely determine whether the new growth arose from the subcutaneous scrotal tissues or from the elements of the spermatic cord due to the distortion resulting from the size of the growth and pressure effects. Curling believed that these tumors developed from the fat of the spermatic cord. Lipomatous tumors lying extravaginally and probably arising from isolated fat cells in the subcutaneous tissues of the scrotal wall are extremely rare. This is due to the fact that fat cells in this areolar tissue are exceptionally few in number and may be entirely absent.

Intrascrotal tumors have occurred most frequently in men between the ages of forty and sixty, rarely in the adolescent and never in infancy. They vary in size, weighing as much as twenty pounds and descending to the knee, as in one case reported by Kocker, and are encountered most frequently in the left side. Occasionally, a history of trauma is obtained. Recurrence after surgical removal is common and sometimes is found to be malignant. Curling operated upon a patient four times over a period of many years for recurrences, evidently dealing with a mixed tumor. C. Bonney reported a case of bilateral scrotal lipomata, surgically removed after twenty-one years duration, and nineteen years later there was a sarcomatous recurrence on the left side.

In spite of the large size of these tumors the testicle and epididymis, as a rule are not affected. These tumors cause very little disturbance, the patient simply experiencing the discomforts that result from its size and weight.

Diagnosis must be differentiated from an irreducible omental hernia, a cystic tumor of the testicle or an hematocele. It is particularly difficult to make the diagnosis when the lipoma can be pushed back through the inguinal ring as if one were apparently reducing a hernia. In cases of a fatty tumor in the scrotum, Cecil advises one to bear in mind that a small hernial sac may be found within it, i.e., there is a hernia surrounded by fat. Therefore, in removing a lipoma of the scrotum, it is essential to investigate the inguinal ring for the presence of a herniation. Although the characteristic cystic feel and lobulations of a lipoma make one suspect its presence anywhere in the body, in the scrotum the diagnosis is difficult and is rarely made without an exploratory incision. The treatment consists of a thorough and complete excision of the growth to prevent recurrence.

Macroscopically and microscopically intrascrotal fatty tumors simulate lipomata found in the human body. The adipose tissue of which they are composed is arranged in lobules and differs little from normal fat except that the cells and lobules are usually larger and less regularly arranged and is paler than normal fat, so that if such a tumor is situated in adipose

tissue its limits can be readily outlined. They are usually encapsulated, making excision easy.

The following case came under our observation at the Kings County Hospital. The preoperative diagnosis was probable fibrolipoma of the scrotum, originating from the subcutaneous tissues of the scrotal wall.

Mr. J. Y., aged fifty-nine years, was admitted to the hospital on August 29, 1935, complaining of swelling in the region of the left testicle of two years duration, which has gradually increased in size. Although a laborer, the patient could not recall receiving any injury to this region. There was never any evidence of inflammation or pain. His family history is irrelevant. With the exception of a case of uncomplicated gonorrhea at the age of eighteen years, the patient's health has been remarkably well. There have been no operations or injuries and he denies a penile sore by name and description. He is married, has three children and his wife is living and well.

Physical examination showed an extremely well nourished adult male not appearing ill. The pupils were equal and reacted to light and accommodation. The teeth were in poor condition. The lungs were normal on percussion and auscultation, as was the heart. The abdomen was negative, no masses were palpable. The blood pressure and pulse were within normal limits. In examining the external genitala, the penis was normal, no discharge. Both the right and left testicles and epididymi were normal. No inguinal hernias were found. In the left side of the scrotum was palpated a soft, nodular, nontender, almost cystic mass about the size of a small orange. There was no fluid and light was not transilluminated. The tumor was not attached to the testicle, epididymis or spermatic cord but was adherent to the lateral and posterior walls of the scrotum. Rectal examination was negative. Urine analysis and Wassermann were negative.

Operation. Under gas-oxygen anesthesia, an anterior incision was made through the scrotal skin and dartos exposing the mass, which was definitely encapsulated and removal was accomplished without difficulty. The tunica vaginalis was not opened. As far as we were able to determine, the growth was not attached to the cord. Recovery was rapid and complete.

Pathological Report. The mass is about 3 by 3 inches in size and is composed wholly of adipose tissue. The tumor surface is irregularly

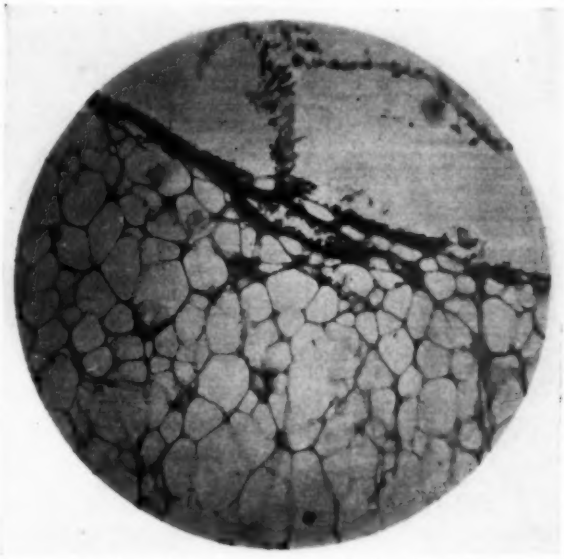

Fig. 1. Section of tumor removed showing the typical fatty structure. (Magnification 120 ×.)

nodular. The cut surface is lobulated and in appearance like normal fat. Microscopic sections made from several parts of the tumor show the usual characteristics of a lipoma. There is no evidence of malignant degeneration.

Diagnosis. Lipoma.

CONCLUSIONS

The case reported is one of a pure lipoma of the scrotum occurring in a male of fifty-nine years. The tumor was situated extravaginally, attached to the scrotal wall and had no connection to the spermatic cord. Its probable origin was from fat cells in the loose areolar tissue beneath the dartos. Complete recovery followed simple excision.

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PLACENTA ACCRETA

REPORT OF A CASE*

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WEEHAWKEN, N. J.

THE literature of placenta accreta consists chiefly of personal case reports. It was Polak's masterful contribution in 1925 that aroused interest in this unusual condition, and Arthur C. Tiemeyer further enriched the literature with his noteworthy article in 1930. However, in 1933 Phaneuf made a thorough and exhaustive search of the literature collecting 82 cases; tabulated his findings and reported 2 additional cases. Since his publication a case has been reported respectively by E. Capecchi, S. Freitas, G. Giavotto, H. O. Newman, R. K. Smith, Solomon and Bourke, making a total of 90. With my case, herein discussed, the number of authentic cases reaches a total of 91.

That this should represent the true number of cases which have actually occurred, no one, I believe, seriously contemplates. On the other hand, that it is a rarity cannot be denied. Its occurrence ranges between the estimated 1 in 6000 by Polak to 1 in 40,000 by Hirst, with an average of 1 case in 14,622 deliveries according to Phaneuf.

A distinction must be made between a retained placenta, an adherent placenta and a placenta accreta. The former is a detached placenta retained in the uterine cavity by a premature closure of the retraction ring; the second is a placenta which fails to detach itself usually because it is thinned out over a large area but can be easily removed manually and in toto because a line of clevage does exist and is easily found by the gloved fingers; the third, or placenta accreta, is one where an intimate union exists between the placenta and the uterine muscle. The term itself is derived from the Latin: ad-crescere meaning "to grow to." Hence a spontaneous detachment can never occur and a manual removal is not only impossible but laden with deadly danger. Phaneuf states that in a series of 36 cases treated by manual extraction 26 died and 10 recovered. "The women who recovered" he believes, "probably had partial placenta accreta . . . for it seems almost unbelievable that one could separate an entire placenta from the uterine musculature without tearing the uterus and without severe hemorrhage and sepsis, the complications to be feared and which usually result in death when this method is persisted."

The mechanism by which a placenta accreta forms is supposed to be simple. It is believed that it results from the absence, total or partial, or abnormal alteration of the decidua basalis which leaves the unprotected uterine muscle wall a prey to the penetrating and erosive action of the trophoblasts and chorionic villi. An idea of this erosive and penetrating activity can be gained by the case reported by C. E. Tennant, where the autopsy demonstrated that the placental attachment not only penetrated the peritoneal coat of the uterus in the fifth month of gestation, but that it actually invaded the visceral cavity.

The causes of the absence of the decidua basalis are protean and, according to the authorities, may be summarized as previous manual removal with febrile reaction, as in the case herein presented, repeated curettages, submucous fibroid (as was one of the cases reported by Polak), endometritis, and abnormal position of the placenta as in placenta previa.

I confess that I cannot be in complete accord with this. It seems to me that if

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these etiological factors were true, placenta accreta would be encountered more frequently. It is true that these causes damage the endometrium and that a normal endometrium is necessary for the proper development of the decidua, still, as Tiemeyer very properly says, "Other factors, however, enter into the formation of the decidua. . . . It is believed that the hormones from the corpus luteum control the formation of the decidua, and abnormalities of the corpus luteum may have some bearing on the formation of this condition by producing a defective decidua basalis."

The following report is published not only because of the rarity of placenta accreta, but also to stress the dramatic results which may attend the management of such a case.

CASE REPORT

Mrs. A. C., a secundigravida 36 years old, was seen on September 30, 1934. Her history is devoid of interesting data except that following the normal birth of her previous and first child on May 1, 1931, the placenta failed to be expelled and was retained for three hours, when a physician called by the midwife in attendance, proceeded to manually deliver the placenta in toto. The following day, however, the temperature rose to 102°F., and persisted with slight variations for eleven successive days.

Early in the afternoon of September the 30, 1934, the midwife in attendance called me to see this patient. I noticed a prolapse of the cord and an abundance of meconium. Examination revealed a podalic presentation and in order to obtain a living child I proceeded to deliver the fetus. Some difficulty was encountered in the deliverance of the head especially since the parturient was extremely uncooperative. A 7½ pounds male child was finally delivered but was asphyxiated. The several procedures for resuscitation were employed and ten minutes afterwards the first cries of life were noted. While occupied resuscitating the child I was noticing, nevertheless, that the patient was having a profuse hemorrhage. My efforts, therefore, were turned to the mother. After several attempts at expelling the placenta, Crede's method was tried, but without success, the hemorrhage continuing with alarming signs. Since the safety of the patient seemed at stake, resort was made to manual removal,

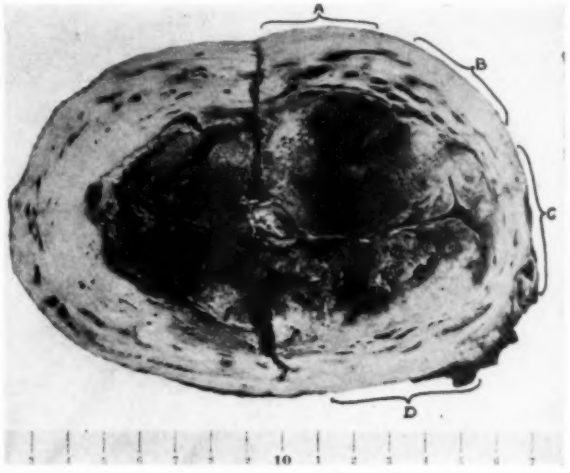

Fig. 1. Photograph of specimen through a plane at right angles to the long axis of the uterus. Sections were cut along the circumference from A to D.

but the gloved fingers sought vainly for the familiar line of cleavage. The patient by now seemed to be rapidly sinking. She was cold and clammy perspiration covered her face and limbs: her pupils were dilated and vision dimmed; the pulse was imperceptible and the heart sounds rapid and feeble. A sterile pack was therefore quickly inserted, the foot of the bed elevated, heat applied and hypodermic injections of camphor in oil, adrenalin and caffein sodium benzoate were given in rapid succession. As her condition was critical she was hospitalized immediately.

Heroic therapeutic measures were instituted; the foot of the bed elevated, intravenous clysis of saline and glucose; black coffee and whiskey per rectum; hot water bottles and warm blankets—and cardiac stimulents. After an hour or so she improved somewhat temporarily. That evening her condition again became precarious and she was transfused receiving 500 c.c. whole blood. The improvement in her condition was striking.

Twenty hours after her admission the packing was removed; the bleeding had stopped. In an effort to extract the placenta without much interference, 250 c.c. of sterile saline was injected into the cord vein, the latter clamped and an ampoule of obstetrical pituitrin administered. The result was negative and a placenta accreta was accepted as the likeliest diagnosis.

Gynecological consultation confirmed the necessity of supravaginal hysterectomy. Her condition, however, justified postponement for another day in order that she could be better prepared for the operation.

That night she developed a chill and her temperature spiked to 103°F. Another chill and elevation of temperature occurred the next morning, but even though this was attributed to sapremia, it was evident that no time was to be lost for the operation.

Actuated only by the desire to avoid the operation, while the patient was under gas, oxygen and ether anesthesia, a last attempt was undertaken to extract the placenta manually. While introducing my fingers in the uterine cavity and as gently as possible seeking the edge of the placenta, the uterine wall at the level of the internal os posteriorly, suddenly gave way, as if offering only a tissue paper like resistance, and the peritoneal cavity was entered. A speedy supravaginal hysterectomy with drainage was done immediately, while an intravenous infusion of saline and glucose was being administered concomitantly. The tear was verified by sight and the presence of fresh blood.

Inasmuch as the prognosis was questionable, an indirect transfusion of 500 c.c. citrated blood was given her while in bed. After three days of stormy convalescence she began to respond favorably. She was discharged from the hospital fully recovered, 27 days after admission.

Pathological Report by Frederick A. Hemsath, M.D.

Fig. 2. Low power microphotographs of celloidin sections from the areas A to D in Fig. 1. Note the greatly dilated venous channels. The blocked area 1, magnified in Fig. 4, shows the thickest portion of decidua found in these sections.

Specimen consists of a supracervical portion of uterus measuring 14 cm. in height, 15 cm. in width and 12 cm. in thickness. Section after preliminary fixation shows the uterine wall 3 cm. in thickness along the lower uterine segment and 1.4 cm. at the fundus. A placenta is firmly adherent to the midportion of the cavity and the myometrium beneath the placenta shows greatly dilated venous channels. The uterus shows no evidence of rupture nor hemorrhage into any portion of the lower uterine segment.

Microscopic Examination. Sections from one-half circumference of the uterus along the placental implantation (Fig. 1, A, B, C, D.) are cut 16 millimicrons in thickness after celloidin imbedding and stained by hematoxylin and Orange G. Examination shows a deficient decidua vera with absence of decidua spongiosum. The chorionic villi are separated from the myometrium by a fibrinous layer (Nitabusch) of varying thickness beneath which, in many places, there is a layer of dense decidua. In other areas the fibrinous layer is directly in contact with myometrium. The only endometrial gland seen is present in a portion of decidua capsularis. Groups of chorionic wander-

ing cells are found at short distances within the myometrium but actual penetration of villi into the myometrium is not noted.

Fig. 3. A higher magnification of blocked area 2 of Fig. 2 showing fibrinous layer in direct contact with myometrium.

Polynuclear infiltration of the placenta, decidua and myometrium is extensive in some areas.

Diagnosis: Placenta accreta, acute placentitis and myometritis.

At this time some pertinent remarks on the history as given become evidently necessary.

It is known that placenta accreta does not cause any postpartum hemorrhage. How then can the serious hemorrhage sustained by this patient be explained? I believe the answer is simple. The patient was "uncooperative" during the somewhat difficult extraction of the head, and realizing that no undue effort was exercised in introducing the hand in my last effort to extract the placenta, it becomes evident that the bleeding came from a tear in the cervix caused while delivering the head, and it was this tear that made the subsequent perforation so effortless. The bleeding could also have occurred from a partial separation of the placenta but Doctor F. A. Hemsath in examining the specimen told me that "the placenta and its membranes were firmly adherent to the myometrium and at no point could separation be found."

SUMMARY AND CONCLUSIONS

1. The literature of placenta accreta is reviewed. To date there are 90 cases reported. My case brings the total to 91.

Fig. 4. Higher magnification of blocked area 1 of Fig. 2 showing, from above downward, chorionic villi, fibrinous layer, decidua compacta and myometrium.

2. Placenta accreta is not well known. The lack of knowledge of this condition plus the lack of hospital facilities in many regions must of necessity keep many other cases from the literature.

3. The role of the corpus luteum in the etiology of placenta accreta should be more thoroughly investigated.

4. Postpartum hemorrhage does not occur in placenta accreta. When it does occur it is due either to cervical tear or to partial placenta accreta.

5. If after delivery of the fetus the placenta is not expelled the known maneuvers to promote this should be tried. As a last resort, under asepsis, the gloved fingers should be inserted into the uterine cavity in an attempt to expel the placenta

manually. If no line of cleavage can be found the project should be abandoned for a placenta accreta then exists. Removal to a hospital and supravaginal hysterectomy usually give favorable prognosis.

6. Any persistent attempt to manually remove a placenta accreta is foolhardy. Fatal hemorrhage, sepsis and perforation are the usual outcome.

7. A case of placenta accreta is reported in detail.

The writer wishes to express his gratitude and appreciation to Dr. W. L. Yeaton, Jr., for his assistance and helpful suggestions.

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REVERSED COLLES FRACTURE: CLOSED REDUCTION

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RECENTLY Webb and Sheinfeld reported a case of reversed Colles fracture which could not be reduced by closed manipulation and had to be disimpacted by means of chisel-leverage following open exposure. A review of the literature by these authors did not reveal a single case in which a successful reduction was obtained by the closed method. They therefor concluded that such fractures should be considered irreducible except by operative means.

The successful management by closed manipulation of a case of reversed Colles fracture with the preoperative roentgenogram was presented by Roberts; but unfortunately postoperative films were not shown.

No adequate explanation for the failure of manipulative disimpaction of such fractures has been advanced, except by Hitzrot, who reported a case in which the sharp distal end of the proximal radial fragment was enmeshed in the annular ligament.

A case of reversed Colles fracture has been encountered by the author which yielded to closed manipulation, and, in view of the many communications to the contrary, merits report:

G. S., a fourteen year old schoolboy was seen on December 3, 1934, about six hours after a fall upon his plantarflexed left wrist. The left wrist and hand were so diffusely swollen as to prevent recognition of any of the bony landmarks. The left hand was maintained in marked plantarflexion and in moderate radial deviation; any attempt at altering this position was strongly resisted by muscle spasm. Palpation of the distal end of the radius caused excruciating pain. Roentgen examination revealed a complete oblique fracture of the anterior lip of the distal end of the radius with antero-radial displacement of the distal fragment, which contained most of the distal radial epiphysis. (Fig. 1.)

Under gas-oxygen anesthesia the hand could not be dorsiflexed beyond 180°. The impaction was then disengaged with comparative ease by increasing the plantarflexion of the hand. The reduction was completed by gradually bringing the hand up into extreme dorsiflexion, the thumbs of the operator pressing upon the distal fragment from its volar aspect while the assistants maintained traction upon the fingers and countertraction against the flexed elbow. The final position was retained by means of a lightly padded circular plaster-of-Paris cast extending from the proximal interphalangeal joints to just below the elbow. (Fig. 2.)

FIG. 1.

FIG. 2.

Postreduction roentgenograms revealed satisfactory reduction of the fracture. After two weeks an anterior molded plaster-of-Paris splint maintaining the wrist in 120° extension was substituted for the cast. In turn this was discarded at the end of a week, at which time the *x*-ray

[*Concluded on p.* 163].

PANCREATIC CONGESTION LIMITED TO CAUDAD PORTION

GEORGE FERRÉ, M.D.

LAUPAHOEHOE, HAWAII, T. H.

FILIPINO laborer, aged thirty-five, was brought to the dispensary of the Laupahoehoe Sugar Company, at Papaaloa, Hawaii, on the morning of June 11, 1935, suffering with abdominal cramps, reported to be in a dying condition. Friends had brought him practically unconscious from one of the nearby laborers' camps.

Chief Complaint: Terrific pains in the upper left quadrant.

Present Illness: He had been at work the previous day, doing heavy manual labor. During the early morning hours of June 11, he was seized suddenly with such strong knifelike pains, continuous but nonradiating, that he fainted. Friends found him as he was reviving and brought him to the dispensary. There was no other localization of the pains. He said that it felt as though someone was turning a knife in his left side, while "squeezing" him in an "iron clamp." He felt very warm at first, but later very cold and weak. There was no vomiting during the first six hours of the attack, but seven or eight hours after the onset of the pains there was a mild regurgitation of bilious material. He complained that his head was "very heavy."

Past History: For the past ten years he has been a resident of Hawaii, before that time he lived in the Philippines. He has had some childhood diseases, and a few attacks of the common cold; otherwise his past history is entirely negative.

Family History: His father, mother and two brothers were living and well. There was no familial diseases in immediate family.

Physical Examination: A moderately well nourished Filipino, lying on his left side, moaning with pain.

His teeth are in poor condition, and the gums are soft and pale. The tongue is not unusual, and his throat negative.

The lungs sounds are normal; no rales heard. The heart borders are within normal limits. The apex beat palpable at the fifth interspace in the midclavicular line. No murmurs are heard. The pulse was 120 per minute when first seen, but in the course of an hour it came down to 84, regular and strong. His temperature was 103.0°F. by mouth.

The abdominal wall is well developed, and exceedingly muscular, with a distinct spasm over the left side, and a less perceived spasm on the right side. Some tenderness on palpation over the entire abdomen, but he was extremely tender in the left upper quadrant. The palpation and percussion were done with difficulty because of the pain and the moderate rigidity. There was no mass or hernia that one could palpate. The abdomen was not distended. There was no icterus.

Reflexes, sensations, and development of the extremities are normal.

Summary: A Filipino male complaining of severe pains in the upper left quadrant with negative examination except for a marked tenderness and rigidity with muscle spasm over the left upper quadrant, and temperature 103°F.

Progress: He was observed for ten days before operation. During this period, his temperature rose consistently to 101.5° in the afternoon from a morning temperature of about 99°F. His respiration varied from 20 to 30 per minute, and his pulse from 68 to 94. He continued to complain of severe pains in the left side, except on the fourth hospital day when he was free from pains. During this time, he was given

a light oriental diet, quite bland, no sedatives, and no other treatment but rest in bed.

On the eleventh hospital day he was seized with the same type of pain as on the day of admission. The white count was 18,000, with 78 per cent polymorphonuclear, the red count was 4,500,000. The urine was negative. His temperature was 99.6°, and his pulse was 80.

The only other remarkable feature was a marked loss of weight. He lost nearly twenty pounds in eleven days, in spite of a fair appetite.

Operation: Under ether anesthesia a large left rectus incision was made, and the accessible portions of the liver, spleen, and stomach explored. Numerous fatty placques were seen scattered over the gastrocolic ligament and the lower pole of the spleen. The kidney was palpated through the peritoneum.

The portion of the gastrocolic ligament within reach was divided and the tail and a part of the body of the pancreas exposed. The tail was seen to be swollen and glistening under the distended peritoneal covering (commonly called its capsule). The "capsule" was divided and three small Penrose drains inserted.

A right rectus incision was now made, and the gastrocolic ligament again divided. The edema of the pancreas ceased abruptly at a point close to an arbitrary line dividing the caudad portion of the organ from its body. The cause of the evident obstruction was not found after careful palpation. The organ itself was not explored surgically. This portion of the gastrocolic ligament was sutured, the gall bladder was inspected and palpated, and the incision closed without drainage.

The first incision was now closed, leaving the Penrose drains in situ.

Convalescence: This was entirely without incident. A slight fever on the second and third postoperative days (99.6°–100.8°) and some expected discomforts were the only features, the patient leaving the hospital on the twenty-first postoperative day. Ten weeks after the operation he returned to his former work. There has been no recurrence of symptoms.

SUMMARY

A case of possible obstructive pancreatitis is reported, which recovered after surgical intervention.

CONCLUSION OF DR. GAYNOR'S ARTICLE*

film revealed satisfactory callous formation. The patient was last seen March 4, 1935, when no limitation of carpal motion was found, nor was there any apparent or mensurable disturbance of growth resulting from the trauma sustained by the distal radial epiphysis.

CONCLUSIONS

1. A case of reversed Colles fracture successfully treated by closed manipulation is reported.

2. The impaction of the fragments appears to be the obstacle impeding reduction, and should be overcome by increasing the deformity manually before restitution of alinement is attempted.

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* *Continued from p. 161.*

TWO INTERESTING CASES OF FRACTURE OF STERNUM

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TEXTBOOKS of surgery class fractures of the sternum as a rare entity. Papers by Ashhurst[1] in 1862, and Gurlt[2] in 1864, emphasized the infrequency of this injury during that period. Speed[3] in 1916 reported 12 cases in a series of 11,302 fractures seen at the Cook County Hospital over an eight year period. Stuck[4] studied the Mayo Clinic cases in 1934 and found that 8 of these fractures represented the total number seen. However, 4 of these had been treated the preceding year. Holderman,[5] in 1928, recorded 3 recent cases which he had diagnosed and treated.

Without doubt, the automobile and improved *x*-ray facilities and technique are bringing more of these fractures to the surgeon's attention. In one month we have encountered 2 cases of complete fracture of the sternum. The account of each is as follows:

CASE I. Mrs. L. L., age sixty-three years, entered the Evanston, Illinois, Hospital three days after an automobile accident in which she had been thrown violently against the back of the front seat. She had difficulty in recalling any of the details incident to the accident or the manner in which she was injured. First aid had been administered in an outlying hospital and the patient allowed to return to her home. Persistent pain in the back of the neck and shoulders prompted her to seek further medical counsel. When seen the symptoms were localized chiefly in the back of the neck. Respirations were not painful and there was no apparent limitation of expansion. The patient thought there was an abnormal forward angulation of the cervical spine. An *x*-ray of the latter failed to reveal evidence of bony injury. Improvement followed physical therapy treatments to the neck and back. The patient was discharged from the hospital after three days of observation. She returned two weeks later feeling much better but stated she had discovered a lump near the upper limit of the sternum. Palpation revealed an irregularity near the junction of the first and second parts of the sternum with overriding of the fragments, the gladiolus being displaced anteriorly (Fig. 1). There was no evidence of callus formation but absence of crepitus and pain suggested satisfactory healing. Three weeks later she was still symptom free.

CASE II. The second case was the result of a fall from a scaffold. Mr. A. P., age sixty-two years, entered the Evanston, Illinois, Hospital in moderate shock complaining of pain in the chest, anteriorly, difficulty in breathing because of painful inspiration and pain in the back. Physical examination revealed a deformity of the upper part of the sternum suggesting complete fracture with overriding of the fragments, the lower segment being displaced anteriorly (Fig. 2). Radiologic study confirmed the clinical examination. The only treatment employed was keeping the patient in the supine position for two weeks. It was felt that immobilization was contraindicated because of a preexistant bronchiectasis. After the first week practically all pain had disappeared. At the end of the third week the patient was walking about with little discomfort. Five weeks later the patient was practically symptom free.

Most accounts of the treatment of uncomplicated fractures of the sternum lack convincing authority. As in all fractures with displacement of the fragments, anatomical reposition followed by temporary immobilization represents the ideal treatment. Unfortunately, this is usually difficult of attainment in fractures of the sternum. According to certain writers, failure to obtain reduction by closed methods should be followed by an operation and the depressed fragment elevated by means of a hook, an elevator or some other mechanical devise. Holderman was able to obtain reduction in 2 of his cases by hyperextending the dorsal and cervical spine and exerting digital pressure over the projecting fragment. Partial immobilization was accomplished by applying a tight adhesive swathe around the upper chest

and keeping the patient in bed. Stimson[6] described a case in which reduction was effected after three days of simply keeping the patient recumbent with the head and shoulders thrown back.

Fig. 1.

Fig. 2.

It is doubtful if present day authorities have added a great deal to Ashhurst's summary, published nearly a century ago, regarding the treatment of fractures of the sternum; "I should be governed by the same rules as in fracture of the skull with depression; if there were already an external opening, I should remove any loose fragments, and endeavor by appropriate means to restore the parts depressed to their natural position; but in the case of a simple fracture I should hesitate very much before resorting to any such heroic mode of practice."

It is quite likely that the advice of Ashhurst was tempered by his wholesome respect for the dangers attendant upon an open reduction of a simple fracture at that stage of the development of surgery. Nevertheless we must conclude that in his experience nonreducible, but uncomplicated, fractures of the sternum healed without difficulty.

While it is admitted that 2 cases are inadequate to justify any dogmatic conclusions, it is felt that they lend further emphasis to the value of conservative treatment in such conditions.

SUMMARY

Two cases are reported of complete fracture of the sternum with moderate displacement of the fragments in which a good functional union was obtained without manipulation or immobilization.

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GALLSTONE OBSTRUCTION OF BOWEL

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THE etiology of bowel obstruction is frequently obscure and frequently regardless how thorough and painstaking the investigation, one is surprised when the ultimate cause is uncovered either at operation or at postmortem examination. A case recently under observation had certain features of rather unusual interest and seemed worth while recording.

A female patient, aged seventy-two years, entered the hospital complaining of nausea, persistantly increasing vomiting and epigastric pain of three days duration. She was perfectly well prior to onset of these symptoms. Two years previously she had a similar attack which lasted for two weeks. She had had no gall-bladder colic, jaundice or vomiting of blood. In the past, there have been attacks of diarrhea which lasted only a day. She has had food dyscrasia. Recently there has been some swelling of the ankles and shortness of breath. On physical examination patient was found to be obese and seemed quite dull mentally. Temperature, pulse and respiration were normal. The heart and lungs were normal. The abdomen was very much distended with marked tenderness in the right lower quadrant. There was ankle edema. Blood pressure was 172/70, the urine was scanty and showed a trace of albumin and some white blood cells. Two white blood counts showed leucocytosis of 15,000 and 12,000. Non-protein nitrogen 97 mgm. per 100 c.c. of blood. Patient refused surgery. Hot turpentine stupes were applied, milk of molasses enema given and the Wangensteen method of siphonage was used to control the vomiting and reduce the distention. The second day after admission the patient was comatose, the distention increased and she died the fourth day after admission.

The postmortem findings are reported from the records of Dr. E. Thurston, resident pathologist.

Body is that of a well nourished elderly white female. Livor mortis is present in the dependent parts. There is a huge distention of the abdomen. There is a moderate pitting edema of the ankles.

Abdominal Cavity: Upon opening the abdomen the greatly distended loops of small intestine force their way into the incision. These loops are markedly engorged, and from the serosal surface small quantities of fibrin may be scraped. There is no free fluid or gas present.

Thoracic Cavity and Organs: Both lungs are bound down on all surfaces by old adhesions. There is no free fluid in either pleural cavity. On section, the lungs are crepitant, with a few areas of atalectasis. There is no free fluid in the pericardial cavity, and no changes are noted in the endocardium except for a slight degree of thickening of the aortic cusp of the mitral valve. Myocardium is firm. There is a slight degree of fatty infiltration into the right heart muscle. There is a slight degree of arterio sclerosis of the coronaries and aorta.

Abdominal Organs: The previously described degree of distention is found to end abruptly about 20 cm. proximal to the ileocolic valve in the ileum. Distant to this point the ileum is apparently of a normal appearance. A firm mass lying within the lumen of the ileum at this point is found to be the cause of the distention.

Stomach: No changes are noted in the stomach except for a slight degree of congestion. The mucosa of the duodenum is hyperemic and shows many petechial hemorrhages.

Gall bladder is found adherent in the first part of the duodenum. Upon opening the duodenum a fistula is found between the fundus of the gall bladder and the lumen of the duodenum. This opening is approximately one centimeter in diameter. Upon opening the gall bladder, several small stones are found in the contracted sac. The ampulla of Vater is found to be patulous and shows the signs of the previous passage of gallstones by the tears in the walls. The common bile duct is opened and no changes noted in the hepatic ducts. The cystic duct is found and dissected, it ending blindly at its junction with gall bladder.

Jejunum and Ileum: The mucosa of the opened jejunum and ileum everywhere is markedly engorged and shows in many places small spherical ulcers. Dissecting down to the point of obstruction the cause is found to be a gallstone, measuring 4 cm. in length and 2 cm. in breadth. At the point of impaction, the mucosa is markedly ulcerated. No changes are noted in the colon.

Kidneys are somewhat larger than usual, the capsules of each stripping easily but the surfaces are finely scarred and several small cysts are noted. On section there seemed to be a thinning of the cortex. There is granular appearance and irregularity of the columns of glomeruli. There is an increase in the peripelvic fat. No changes are noted in the ureters or bladder.

Ovaries are atrophic; the uterus is small and hard.

Provisional Anatomic Diagnosis:

1. Old cholecystitis and cholelithiasis.
2. Cholecystoduodenal fistula.
3. Acute intestinal obstruction due to gallstones.
4. Toxemia.
5. Chronic parenchymatous nephritis.

We have reviewed a series of cases recently reported in various journals and have noted the features of interest which are prominent in the symptomatology and treatment of the cases. It is obvious that the mortality rate is extremely high as the diagnosis is practically never made accurately, although obstruction of the bowel is generally suspected. One very outstanding feature in recounting the case protocols has been that very frequently there has been no history of either gall-bladder colic or gall-bladder dyspepsia, and very frequently likewise "scout plates" of the abdomen have failed to reveal gallstones.

In our own case the history of gall-bladder disturbance was inadequate for diagnosis, the opening between the gall bladder and the duodenum was scarcely more than one centimeter in diameter. The common duct was small and constricted but this huge gallstone could find an unphysiologic exit from its habitat in the gall bladder and still obstruct the bowel and cause death. This occurred in a portion of the bowel where distensibility is great and where there is no sphincteric action to be responsible for the obstruction.

Reference has been made to the passage of large gallstones through the common duct causing obstruction of the small bowel. Still we could find no example of this type of stone migration. The stones generally recorded have been of more or less uniform size of 3 to 4 cm. The mortality, although unusually high, seems to depend in a measure on several factors. The first and foremost is the failure of diagnosis. The symptomatology is not fulminating enough to persuade the patient to consult the doctor early and the doctor has frequently procrastinated because of the unusual features which generally present themselves at the time of the first examination. Frequently the obstruction at first is only partial and this is often misleading. The second factor in the high mortality rate is the role played by the various degenerative diseases we found in these senile patients. Perforations and peritonitis have likewise been the cause of death.

In our patient the initial examination was made three days after the onset of the symptoms, and although obstruction of the bowel was diagnosed, the patient refused surgery. Preoperative diagnosis did not consider gallstone obstruction but rather a large bowel malignancy. There seems no reason why a reasonably low mortality cannot be obtained in the operative management of these cases if it is felt that the obstruction of the bowel means surgery and that this should be instituted as soon as possible after the onset of symptoms. The comatose condition of our patient and the high non-protein-nitrogen content of the blood, made us feel that uremia was developing, but it should not be forgotten that the bowel obstruction is featured by blood chemistry of that type and should not be considered too seriously in the appraisal of the operability of the case.

In conclusion, gallstone obstruction should not be forgotten in obese individuals with a mild evolution of obstructive symptoms even though there is no past history of gallstone colic or of gall-bladder dyspepsia. *X*-rays will not make the diagnosis which will always be tentative until the visual examination at the operative table or postmortem examination.

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* *Continued from p. 112.*

MYXOSARCOMA OF PROSTATE*

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NEOPLASMS of the prostate of mesothelial origin are rare and myxosarcoma is one of the less common forms of sarcoma of the prostate. Tumors of mesothelial origin may also arise in the bladder or in the retrovesical tissue, surround and invade or even destroy the prostate so that late in the disease their origin cannot be determined. To be certain of the prostatic origin of sarcoma, when studied the tumor must be sufficiently circumscribed and limited in its extent so that there can be no doubt as to its origin. In the case herein described, the prostate per rectum disclosed the gland to be the seat of an inoperable malignancy and cystostomy showed the tumor to be limited at the time to the prostate only.

CASE REPORT

History: A. G., a white male, age forty-six years was first seen November 22, 1933, complaining of difficulty in urination. Three weeks prior to being seen, he had had two attacks of acute retention for which he had consulted a chiropractor who made a diagnosis of prostatitis. Resort to catheterization was made and prostatic massage instituted with some relief. Several weeks after the onset of the symptoms, the patient noted a bulging in the perineum and he was unable to sit down without excruciating perineal pain on the right side.

Family History: Mother died many years ago following cholecystectomy. Father is living and well. Patient has been married seventeen years, wife and two children living and well.

Past History: The patient had the usual childhood diseases, influenzal pneumonia in 1916 and 1918. Six years ago patient developed diabetes mellitus which was easily controlled by diet. At the onset of his diabetes the patient weighed 207 lbs. and at the present weighs 157 lbs. The latter weight has been maintained for the past several years. Insulin has not been employed at any time. About a year ago, patient developed otitis media which subsided without complication.

Physical findings were entirely negative except for the rectal examination. The prostate was so tremendously enlarged the examining finger could not reach the upper border. The mass was soft and doughy in consistency and firmly adherent to the rectal wall although the borders were sharply defined. There were no areas of fluctuation and no history of urethritis. The seminal vesicles were not palpable. Temperature was normal although fever of low degree was present during the previous three weeks.

The patient was again seen at his home on November 27, at which time the temperature was 102. Catheterization was necessary intermittently and when complete retention occurred the patient was placed on constant drainage per urethra.

Rectal examination on December 4 showed the mass to have increased somewhat in size and there was now palpable a firm nodule about 2 cm. in diameter in the left lobe of the prostate. A diagnosis of an inoperable malignancy of the prostate was made at this time, its exact nature being undetermined but apparently not a carcinoma. Cystoscopy was attempted on December 12, but the cystoscope could not be passed because of the obstructing mass in the posterior urethra. The patient was again seen December 29, 1933, and deep therapy was advised inasmuch as the tumor was inoperable. A diagnosis of a possible sarcoma of the prostate was made.

Patient was admitted to Mount Sinai Hospital on December 30, 1933, for deep therapy. He appeared acutely ill and obviously in great pain. There was marked tenderness on pressure in the region of the bladder. On rectal examination the prostatic mass appeared to have increased in size on the right side, the nodule on the left side showed no change, was entirely immovable and firmly attached to the rectal mucosa. Twelve deep therapy treatments were

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given encircling the entire pelvis with the following factors: 200 K.V., 0.75 mm. Cu. plus 1 mm. Al. Filter; 450 or ½ S.U.D. through each portal. The last treatment was administered on January 13, 1934. On January 28, the tumor was apparently the same in size, the nodule previously described very firm, and the general condition of the patient unchanged. Following deep therapy, the patient was able to void without the aid of a catheter.

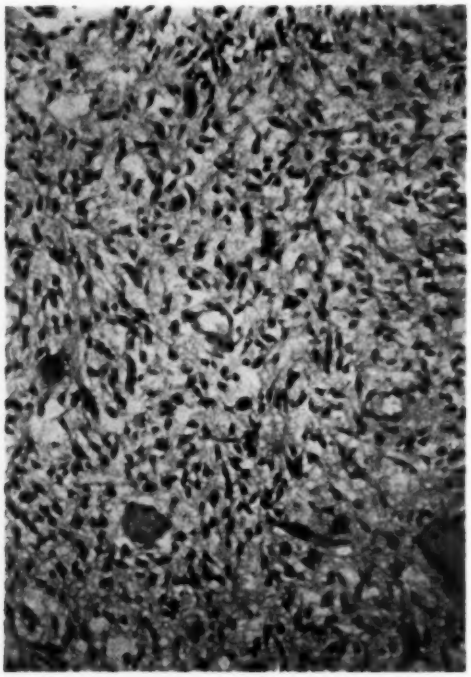

Fig. 1. Myxosarcoma of prostate. (120 ×)

On February 15, the patient developed a thrombosis of the dorsal vein of the penis with marked edema. The tumor mass was larger, firmer and completely adherent. On February 27, acute retention again occurred and cystostomy was advised. Patient was readmitted to the hospital on March 1, for suprapubic cystostomy and radium.

Operation: Suprapubic cystostomy was performed on March 3, 1934. The prostate was tremendously enlarged, very nodular, irregular and covered by intact mucosa. Many of these nodules were cystic on palpation. A portion of the tumor mass was removed with the Bovie. Grossly, the tissue appeared cystic and gelatinous. The cysts were filled with a mucoid substance. Radon seeds were then inserted into various portions of the prostate at different levels. The bladder was closed in the usual manner and the patient was discharged from the hospital on March 17 with permanent suprapubic drainage.

X-ray Report: Roentgenograms taken December 30, 1933, and subsequently during the course of the disease never disclosed any evidence of metastases to the lumbar spine, pelvis, or chest.

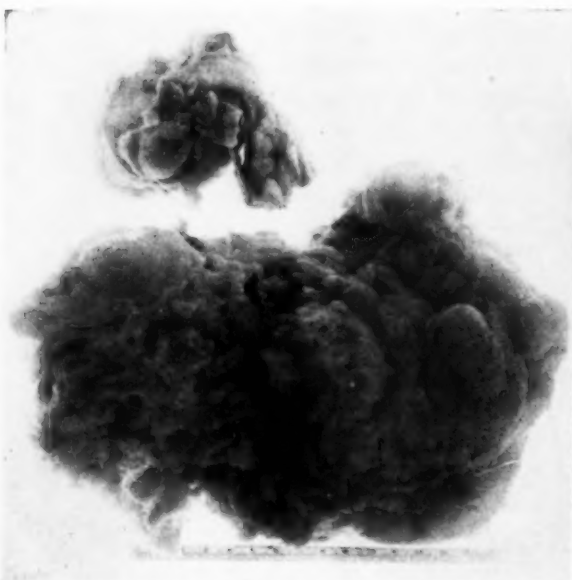

Fig. 2. Gross photograph showing external surface of myxosarcoma of prostate. Tumor masses from pelvis and large intestine.

Fig. 3. Gross photograph showing cut surface. Markers indicate ureteral orifices.

Laboratory Findings: The urine was persistently alkaline in reaction with marked albuminuria and no sugar. Microscopically much pus was present. The white blood cell and the red blood cell counts were normal.

Blood chemistry findings were normal on several occasions.

**Pathological Report:* Grossly the specimen consists of a small mass of tissue measuring 15 × 12 × 10 mm. On the external and cut surfaces the tissue is fleshy, grey, semitranslucent and of fine architecture. In places there are areas of reddish brown discoloration.

Microscopic Description (Fig. 1). No prostatic tissue is present. The tumor is made up of spindle shaped cells with abundant lavender stained cytoplasm. The nuclei of the tumor cells vary considerably in size and shape, the majority are spindle shaped to stellate. Many of the nuclei are large and hyperchromatic. There are a moderate number of mitotic figures present and numerous thin walled blood vessels.

Diagnosis: Myxosarcoma of prostate.

Patient died June 12, 1934. Partial autopsy was obtained. Emaciation was very marked and there was a tremendous suprapubic mass and also a marked protuberant mass in the perineum. Upon making a suprapubic incision, the bladder could not be visualized because of the extent of the neoplasm. As much of the tumor was removed as was possible. The entire pelvis was "frozen" and the tumor tissue was removed with the greatest difficulty. A smaller mass entirely separate from the main tumor was adherent to the large bowel, was easily removed. The kidneys and ureters were normal in size and appearance. There was no adenopathy.

**Pathological Report:* The gross specimen (Fig. 2) consists of two masses of tissue removed postmortem. The larger mass weighs 1600 grams, measures 20 × 16 × 11 cm. and filled the entire pelvis. The smaller mass was attached to the large intestine and measures 6 × 5 × 3.5 cm.

On exploring the larger mass (Fig. 3) the lower portion of the bladder and the ureters are found surrounded by and infiltrated by tumor. The ureters, however, are patent. The tumor mass is of fine architecture, fleshy consistency, greyish white, shows considerable degenerative changes with numerous irregular defects and areas of reddish brown and yellow discoloration suggesting areas of hemorrhage and necrosis.

There is a small amount of prostatic tissue still recognizable at the neck of the bladder. Elsewhere the prostate is entirely replaced by tumor. There are several gold radon seeds in the tumor mass at the neck of the bladder with slight regional reddish brown discoloration.

Fig. 4. Magnification 6×. Prostatic tissue in right lower section. Myxosarcomatous tissue left upper section.

The seminal vesicles are not distinguishable. The urethra is still recognizable in the intact prostatic tissue and continues to the edge of the specimen as a dilated and tortuous structure lined by tumor tissue. There is a portion of the rectum attached to the posterior surface of the mass.

Microscopic Description: (Fig. 4) Three sections show a striking picture. The tumor tissue is composed of adjoining immature fibroblastic cells, with abundant faintly blue stained cytoplasm. The nuclei vary in size in different portions, with occasionally multiple nuclei. In places there is necrosis of tumor tissue. The tumor tissue is observed extending into fibrofatty tissue in one section. Prostatic tissue is recognizable in the lower right portion of the section. Section of the smaller mass attached to the large intestine shows a similar picture. Larger magnifications show sections to be similar to Figure 1.

Final Diagnosis: Myxosarcoma of the prostate, 20 cm. in diameter.

[*Concluded on p.* 185.]

* Pathological Reports by Dr. B. S. Kline and Dr. A. M. Young.

STRUMA LYMPHOMATOSA (HASHIMOTO)

REPORT OF A CASE*

D. HENRY POER, M.D., F.A.C.S., T. C. DAVISON, M.D., F.A.C.S., AND E. L. BISHOP, M.D.

ATLANTA, GA.

SINCE Hashimoto[1] in 1912, first described "a characteristic kind of chronic inflamation" of the thyroid, which he concluded was not in the same category with Riedel's[2] "eisenharter strumitis," there has been considerable controversy as to the actual existence of such a condition as a separate and distinct disease. It is unfortunate that the material for study is confined to a comparatively small group of cases, many of which are incomplete in essential detail; that all authentic cases may be available for study is the purpose of our presentation of this case. There are also several unusual features of interest.

For ten years following Hashimoto's first description there apparently is no mention in the literature of this interesting condition of the thyroid until 1922 when Ewing[3] suggested that struma lymphomotosa was an early stage of Riedel's struma. He states, "that in the early stages the gland is thickly beset with numerous lymph follicles with active germ centers, the reticulum of which become so numerous as to suggest lymphosarcoma—all stages of atrophy of the alveolar epithelium can be traced. Fibrosis and hyaline transformation begin early and eventually, as in Riedel's case, the enlarged gland becomes very firm and dense. It appears therefore that Hashimoto and Riedel have described the early and late stages of the same pathological process."

In 1925 Williamson, Scott, and Pearse[4] studied 2000 specimens of thyroid glands in England, and described the distinctive pathological changes of struma lymphomotosa which they called "lymphadenoid goiter." McCarrison[5] in 1929 was able to produce a condition simulating this in rats by feeding a diet of American white flour, meat residue, olive oil, and table salt containing potassium iodide. Joll[6] in his recent book discussed lymphadenoid goiter which he considered to be an entirely different disease from Riedel's struma. Graham and McCullah[7] reported 4 cases in 1931 which they considered to be Hashimoto's type of struma lymphomotosa.

In the same year (1931) Graham[8] made a thorough review of all the cases available in the literature at that time and found 104 cases which he classified into ten groups. Of these, 41 were classified as Riedel's type of iron hard strumitis, and 24 fulfilled the requirements for Hashimoto's struma lymphomotosa. The remainder of 39 were excluded as not being typical of either. Graham then compared these first 65 cases very carefully in every detail and was able to define a clearcut conception of each. Briefly he says that Riedel's struma "may be looked upon as having a local inflamatory process in the thyroid for which an etiological factor should be sought. The general body economy is affected secondarily by reason of destruction of the thyroid, interference with respiration and deglutition, and injuries to important blood vessels and nerves. Hashimoto's type of lesion may be considered to be a local manifestation of a constitutional disorder—the changes in the thyroid tend to become degenerative rather than inflamatory and sclerosing—etc."

Foot's[9] ideas about these two conditions apparently is much the same. He states that "Hashimoto's struma has no connection with Riedel's struma, and that they

* From the Surgical Service, Georgia Baptist Hospital.

represent two distinct processes—the one an overgrowth of lymphoid tissue followed later by fibrous invasion that may be more

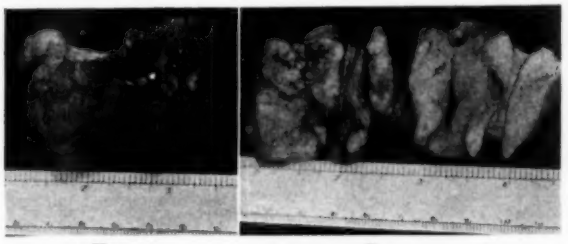

Fig. 1. Fig. 2.

Fig. 1. Gross specimen, anterior surface.
Fig. 2. Gross specimen, posterior surface.

a metabolic than an inflammatory process —the other a fibrous overgrowth in response to some inflammatory stimulus. In Hashimoto's disease we have the lymphoid tissue growing as lymph follicles among the parenchymatous portions of the gland and crowding it out in that way but without the enormous fibrous reaction of Riedel struma. In the latter the fibrous overgrowth seemed to strangle the parenchyma slowly but certainly until it underwent almost total atrophy and was replaced by dense woody masses of connective tissue. The lymphocytic invasion in that case consists more of lymphocytes than of lymphoid tissue with germinal centers as is seen in Hashimoto's struma."

On the basis of these concepts few reports of true Hashimoto's struma lymphomotosa have appeared in the literature since 1931. Eisen[10] presented 4 cases of Riedel struma and 3 cases of Hashimoto's struma in 1934 from the service of Dr. Emil Goetsch in Brooklyn; he considers these to be different phases of the same pathological process. Polowe[11] reported an interesting case in the same year of Hashimoto's struma clinically associated with hyperthyroidism, but his microscopic sections did not seem to bear this out pathologically. Howard[12] has recently added 2 cases to the literature from his experience in Boston; one of these was discovered at autopsy examination. Hertzler[13] in his recently revised monograph, describes Riedel's struma as a type of acute diffuse thyroiditis, and Hashimoto's struma lymphomotosa as a chronic thyroiditis which is localized within

Fig. 3. Giant lymph follicle with well developed germinal center. (×85.)

the capsule (intracapsular). He states that these two conditions "differ chiefly in extent of involvement while they are identical in structure."

CASE REPORT

History. On January 10, 1935, J. L. C., a white female aged thirty-five, came to the office of Dr. T. C. Davison complaining of a goiter and nervousness. She had been quite nervous for the past four years but did not notice the goiter until two months ago and thinks that it is growing. During the same period she has noticed some tightness in her throat with difficulty in breathing and swallowing. There has been no palpitation or other cardiac symptom; the appetite is normal but unable to eat certain foods and sweets. She has much gas but no nausea; diarrhea occasionally. There is no history of goiter in the family. She was born and reared in Georgia, is married and has one child living; no miscarriages. Thinks she has lost some weight lately.

Examination. The patient is of medium statue and weighs 142 pounds. The tonsils are enlarged and cryptic, with evidence of chronic infection. Pupils are equal and react normally; no eye signs of hyperthyroidism are present. The thyroid is quite prominent with equal enlargement of both lobes; the surface is

smooth and no nodules can be felt, no thrill or bruit present. The skin is of normal texture; the palms are warm and slightly moist. There

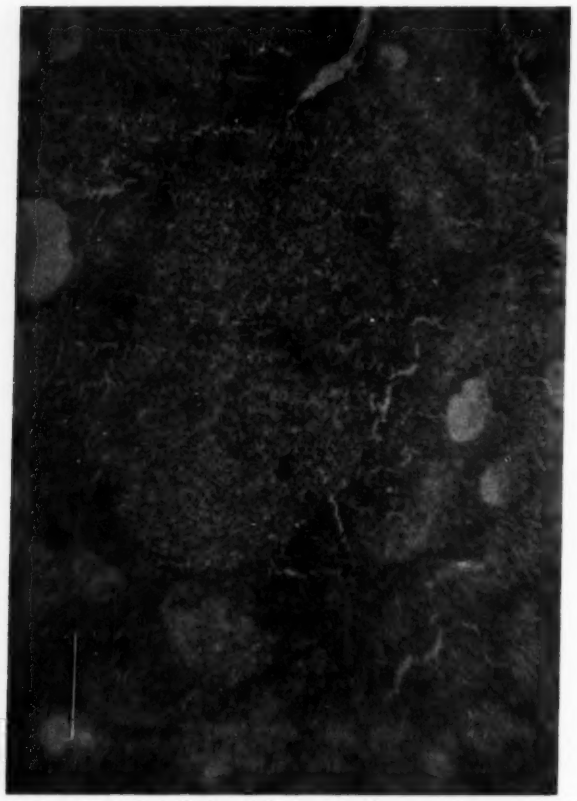

Fig. 4. Lymph follicle with germinal center surrounded by occasional contracted acinus. (× 75.)

is a slight tremor of the outstretched fingers and tongue. Breath sounds are normal, and no râles, friction rubs, or murmurs could be heard. Vocal cord movements normal. Roentgenograms showed no evidence of substernal extension or deviation of the trachea.

Her temperature was 98.6 (F), the pulse 86, blood pressure 120 systolic and 86 diastolic.

Laboratory Findings. Specific gravity of the urine 1.006, contains a trace of albumen, and 10–12 epithelial cells per high power field. Wassermann reaction is negative. Red cells numbered 3,840,000; white cells 9200; hemoglobin 75 per cent Sahli. Differential smear showed 57 per cent neutrophiles, 39 per cent lymphocytes and 4 per cent eosinophiles. The basal metabolic rate was minus 3 per cent.

Operation. She entered the Georgia Baptist Hospital on March 27, 1935 and on the next day a subtotal lobectomy was done on both sides. The area was infiltrated with ½ per cent procaine hydrochloride solution. A low collar incision was made and the muscles separated in the midline. Both lobes were found to be about three times the normal size; they were delivered without difficulty except for many

Fig. 5. Edges of follicle with diffuse lymphoid infiltration, atrophy and disappearance of acini. (× 85.)

fine adhesions to the sternothyroid muscle. Approximately five-sixths of each lobe was resected. A soft rubber protective drain was placed to the stump on each side and closure done in layers.

Pathology. (Dr. A. J. Ayers). Specimen consists of two lobes and the isthmus of the thyroid. Size 10 × 5 × 3 cm., weight 160 gm. The surface of the right lobe is smooth, but on section there is an indefinite nodule filling the lower pole area. Color of the tissue is pale grayish pink, and the consistency is rather soft. The left lobe is the same except there is no nodulation. Capsule is intact. No cysts, hemorrhage, or areas of calcification seen. (Figures 1 and 2.)

Microscopic. (Dr. E. L. Bishop.) Sections taken from various portions of the thyroid show essentially the same structure in the different areas with minor variations. The most striking feature is the presence of a great many well formed lymph follicles with active germinal centers (Figures 3 and 4.) These follicles vary considerably in size, some being very small, others larger than a low power field. Under the microscope no field examined is without one or more of these lymph follicles. There is also a diffuse lymphoid infiltration of the entire gland. The epithelial structures are entirely passive and the acini show various stages of atrophy,

apparently from the pressure of the lymph tissue (Figure 5). The acini are mostly of small size although some of the individual cells show some swelling. Colloid is present in some of the acini and absent in others. Connective tissue formation is rather scanty in this particular specimen, in some areas there being a few bands or bundles, while in the greater portion there is only a fine supporting connective tissue. There is no evidence of active infection; cystic degeneration and adenomatous formation are absent. Vascularity is moderate but there is no hemorrhage. Giant cells and pseudotubercle formation are absent.

Diagnosis. Struma lymphomotosa (Hashimoto).

Postoperative Course. The immediate postoperative convalescence was uncomplicated. The drain was removed on the second day and the patient left the hospital on the seventh day. The wound healed per primum. It is now twelve months since operation and she has remained entirely well. However she is gaining weight and developing other signs of hypothyroidism. The basal rate is practically the same as before operation, minus 2 per cent.

DISCUSSION

On the basis of the signs and symptoms presented, it would seem difficult to have even suspected the true diagnosis in this case. And even after the examination of the gross specimen as removed at operation the soft consistency of the tissue caused no one to consider this type of struma which is usually characterized by a hardness that is extreme in some cases. Therefore we would differ with Graham[8] when he states that the diagnosis should be made upon the clinical and gross findings. It seems that the histology of benign granuloma of the thyroid is quite distinctive in spite of the fact that well formed lymph follicles are found in other pathological conditions of the thyroid, especially in toxic goiter. However, one must realize that in toxic goiter the glandular elements are extremely active, there being a definite hyperplasia, whereas in Hashimoto's struma the glandular structure is entirely passive and eventually disappears even before fibrosis occurs. In many cases it would appear that a dense fibrosis and "ligneous" type of thyroid gland such as described by Riedel follows the lymphoid type of Hashimoto.

On the other hand, some of the cases described as struma lymphomotosa fail to show evidence of conversion from a lymphoblastic to a fibroblastic type of structure. Lymph follicles are not present in the normal thyroid, there being only a scattering of lymphocytes in the stroma. It must be assumed that the newly formed follicles develop from the existing lymphocytes and it may be possible that the lymphoid type of gland represents a sort of "lymphadenitis of the thyroid" with the formation and proliferation of lymphocytes and lymph follicles, the tremendous overgrowth causing a destruction of the parenchyma of the gland.

Assuming that this is a low grade inflammation or thyroiditis as is fairly generally accepted, it is possible that after a variable period of time the active lymph tissue becomes exhausted and then follows a proliferation of the connective tissue eventually involving the entire gland. In this way might be explained the two entirely different structures present in different glands, which are believed by some to be early and late stages of the same disease.

SUMMARY AND CONCLUSIONS

A case of true struma lymphomotosa of the Hashimoto type, which fulfills all the accepted requirements for this diagnosis, is presented in detail, and the clinical and pathological features are described. As this is one of the youngest patients in which this condition has been found, and as the goiter had existed for a short period of only two months, the pathology probably represents the very earliest stages of this condition. The relationship of this type of struma to Riedel's iron hard struma, and a theory as to the explanation of this unusual pathological process is discussed.

[For References see p. 185.]

ACUTE INTUSSUSCEPTION IN EARLY WEEKS OF LIFE*

J. M. MORA, M.D., F.A.C.S. AND L. J. ARIES, M.D.

CHICAGO

ACUTE intussusception is essentially a disease of infancy, the vast majority of cases occurring within the first two years of life and most frequently between the fifth and twelfth months. The disease is apparently rare within the first few weeks of life, comparatively few cases being recorded where the diagnosis was confirmed by laparotomy or necropsy. Still rarer are the infants under twelve weeks of age who successfully withstood surgical intervention.

One of the earliest collected series was that of Hirschsprung,[1] who, in 1895 reported 64 cases, 46 of whom were under one year. The youngest was forty-nine days old and one was fifty-eight days old. No details are given of the individual cases. Hess,[2] in 1905, reported 1028 collected cases. Of 314 in whom the age was given, 8 occurred within the first three months. The 2 youngest each aged six days, died, irrigation only being tried; 3 others of this group were operated, 2 of whom recovered. Clubbe's[3] series of 144 patients did not include one under three months of age. Fitzwilliams,[4] in 1908, collected 1000 cases from the records of the Hospital for Sick Children, The West London Hospital and from the published statistics in the Lancet and The British Medical Journal, from 1891–1908, and from the Transactions of The Clinical and Medical Societies and The Society for the Study of Disease in Children. Only 4 cases appeared before the third month. The disease occurred most commonly between the fourth and seventh months. Inclusive of the 466 cases under one year of age, 64 per cent fell within this period. None of Hipsley's[5] 51 patients was under three months. Perrin and Lindsay,[6] in their monograph based on 400 cases, stated that the vast majority occur during the first two years. Of the 400 patients, 314, or 78.5 per cent, were under two years, while 279, or 69.75 per cent were under one year; and 203, or 72.7 per cent occurred between the fifth and ninth months. Only 9 patients of the entire series were under three months of age. Monrad,[7] physician in chief to the Dronning Louise's Children's Hospital in Copenhagen, in a twenty year period, 1906–1925 saw 115 cases of acute intestinal invagination and only one occurred within the first twelve weeks of life. Of the 363 cases admitted to Guy's Hospital from 1904 to 1927, 71 per cent occurred within the first year. Fifteen patients were less than four months old. Thirteen of these died.[8]

In the literature there are few reports of infants under twelve weeks of age successfully withstanding surgical intervention. Collinson,[9] in 1907, reported a successful enterectomy in a twelve weeks old infant, who was operated seventeen hours after the onset. A remarkable case was recorded by Dowd[10] in 1913, when he successfully resected one-third of the colon including the transverse and part of the descending colon, in an infant five days old who had an irreducible acute intussusception. Operation was performed thirty-seven hours after the onset. Dowd stated that in 1913 only 7 cases of successful resections had been recorded in infants under one year. Four years later Steele[11] operated upon an infant four days old and easily reduced a massive invagination, but the child died the following day. Postmortem examination disclosed free blood and numerous clots in the peritoneal cavity but no evidence of peritonitis or recurrence of the intussusception. In 1919 Flint[12] successfully performed a resection for an acute invagination of forty-eight hours duration. Edington's[13] patient, aged eight weeks, was operated twenty hours after onset, but succumbed within twelve hours following a difficult resection. Another successful operation was reported by Thompson,[14] who recorded the case of a twelve weeks old infant, who recovered after a very stormy postoperative course. Two of the 34 cases

* From the Mt. Sinai Hospital Chicago, Illinois.

from the Philadelphia Children's Hospital reported by Robbins[15] were under twelve weeks of age when operated. One, aged eight weeks, admitted in poor condition with the invagination of three days duration, died on the table after resection. The second infant, aged seven weeks, operated thirty-six hours after the onset, recovered. De Langre[16] recently reported a successful case in a ten weeks old infant, operated ten hours after the onset. In this patient the head of the invagination was found to be a Meckel's diverticulum with a cyst, or an enterocystome.

Because of the foregoing data, the following case is briefly appended:

B. L., male, seventy-seven days old, normally delivered, breast fed infant, was perfectly well until the morning of admission, when his mother noted rectal bleeding without apparent cause. The child became listless and cold. On admission to the hospital within two hours after the onset the rectal temperature was 103°F., the pluse 145 and the respirations 36 per minute. The infant appeared to be well nourished and well developed, but listless. At intervals he sharply flexed the thighs on the abdomen as though in pain. The head, neck, chest, and extremities showed no abnormalities on examination. The abdomen was considerably distended and moderately soft; there were no palpable masses. Rectally, a smooth, soft mass was palpable and blood was noted on the examining finger. Examination of the urine disclosed no abnormalities. Examination of the blood revealed 70 per cent hemoglobin (Sahli), 3,870,000 red cells, and 18,200 leucocytes. The differential leucocyte count was normal. The condition was recognized as an acute intussusception by the resident physician, Dr. Maurice Golden, and the child was immediately prepared for operation. A small Rehfuss tube was passed as a precautionary measure.

Under light ether anesthesia the abdomen was opened through a right paramedian incision. The stomach was enormously dilated and nearly filled the entire abdominal cavity. A mass was found occupying the left half of the abdomen, which on examination proved to be a complete ileocolic intussusception. This was reduced with considerable difficulty and the abdomen closed. The appendix was not removed. Fluids were at once administered subcutaneously and oral feedings resumed the following day. The child made an uneventful recovery and was discharged on the fourteenth postoperative day. There has been no recurrence of the invagination.

SUMMARY

A case of acute ileocolic intussusception is recorded in an infant seventy-seven days old, successfully operated upon within three hours after the onset. Study of the literature emphasizes the rarity of the lesion in the first twelve weeks of life and discloses the records of the comparatively few number of infants who successfully withstood surgical intervention.

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FOREIGN BODY IN URINARY BLADDER

O. P. MAUTERER, B.S., M.D.

OLLA, LOUISIANA

MANY types of foreign bodies have been found in the urinary bladder of the male and female, most or all having been used to produce sexual excitement. From the literature at my disposal I have been unable to find where an animate foreign body has been reported though I was able to find descriptions of sixty-three different types of inanimate objects. Recently I have had such a case and because of the unusual foreign body thought it worthy of reporting.

Recently, Garshwiler et al.* gives an excellent resumé of this condition, explain why more foreign bodies are found in the female bladder than the male and outline the symptoms, complications, etc.; therefore, it is useless for me to repeat them. Garshwiler, in this article, reports the findings of "a large piece of slippery elm bark encrusted with calcareous deposit;" a pink tallow candle 3 inches in length and ¼ inch in diameter found in the bladder of a male, a hairpin in the bladder of a young girl, a stone with a piece of "juicy fruit" gum as a nucleus in a male urethra."

A female patient consulted me for frequent and burning urination and a sensation of crawling over the pubic region. She exhibited a worm about 2½ inches long, about ½ inch in diameter, tapering nearly to a point at both ends. As I had never heard nor seen such an animal expelled from the human body I questioned the patient carefully. She stated that while douching she felt the desire to void, urination was accompanied by severe pain, intense burning and she felt something pass and found the worm in the bedpan. As I did not recognize the organism I shipped it to Dr. J. Cornell at Charity Hospital, New Orleans, La., requesting that he identify it and recommend therapy. He telegraphed "Air breathing gastropod—a variety of snail—could not be internal—entrance from outside—no therapy." On receiving this information I again questioned the patient and told her that it was probably in the bed pan before she used it. She requested an explanation for the severe pain and burning and emphatically denied that it could have been in the bedpan. Several days later she complained still of a crawling sensation in the suprapubic region. She was cystoscoped and another snail without its shell was found in the bladder. This snail was the same type as the first and was dead on removal. I diplomatically hinted that they may have been passed into the urethra by her or someone else. She denied this in a "from the tone of voice" that made me decide it best to discontinue the subject.

This is the first case, I believe, in which a snail was found in the urinary bladder.

I do not believe that this patient felt any crawling sensation suprapubically but that she knew two snails had been inserted into the bladder and only one removed. Therefore, she was worried about the other and desired its removal. It may be of interest to remark that this woman is an epileptic.

* Garshwiler et al. *Am. Jour. Surg.*, 22: 199–203, 1935.

FRACTURE DISLOCATION OF SACROILIAC JOINT

REDUCED BY WELL LEG TRACTION METHOD

WALTER G. STERN, M.D., F.A.C.S.

CLEVELAND, OHIO

E. S. white male, age twenty-seven, was brought to Mount Sinai Hospital Cleveland, Ohio, on the evening of November 1, 1934, evidently having been struck by an automobile while under the influence of liquor. He was found lying semiconscious at the edge of a driveway and was apparently so well "ethylized" that he could not walk or talk coherently.

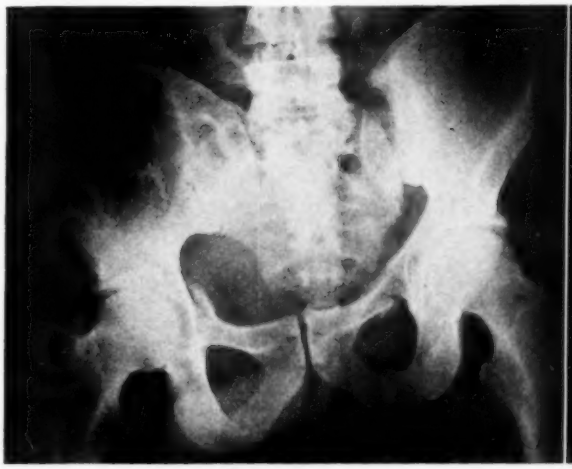

FIG. 1.

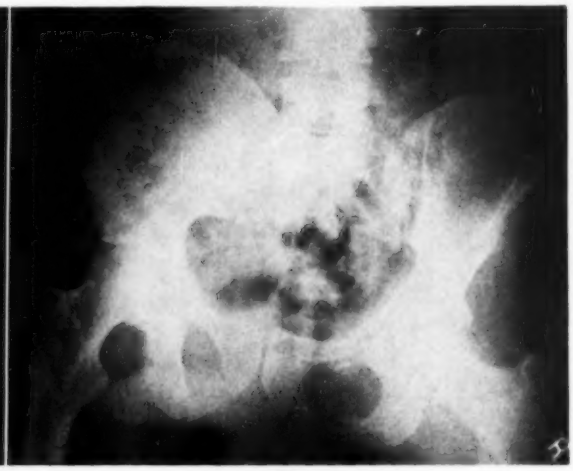

FIG. 2.

While he displayed bruises about his pelvis, he gave no expressions of pain when this was being palpated, he was sent to the Police Station as a simple alcoholic. The turnkey that night noticed that the man's condition was serious and he was immediately transferred to Mount Sinai Hospital in profound surgical shock, still incoherent and still apparently anesthesized by his intoxication. He responded to intravenous injections of gum acacia solution combined with the usual measures against shock.

The next morning was more or less conscious and coherent, and not complaining of any spontaneous pain although the buttocks presented a widespread bloody discoloration. There was no interference in the conductivity of the nerves of the lumbar or sacral plexus although the patient could not coordinate. Pressure on the iliac crests were not painful. The right leg was shorter and the trochanter higher than the left; although the hip joint seemed normal, fracture of the neck of the femur could not be ruled out entirely.

X-ray film revealed fractures through the right sacroiliac joint with a 2½ inch upward displacement of that side of the pelvis; fractures through the horizontal and descending rami of the right side of the pelvis and the transverse and descending rami of the left side with some upward dislocation or twisting of the fragments. (Fig. 1.)

Under the anesthetizing influence of the alcohol, plus focal anesthetic at the point of insertion, a Steinman pin was drilled through the lower end of the right femur and firmly attached to a plaster cast extending from the foot to the groin by means of perforated aluminum strips. Another cast was put on the left leg and foot and a well leg traction apparatus attached to both casts and maximum traction, extension and abduction were applied to this limb as could be obtained from the apparatus.

X-ray pictures ten days later showed practically complete reduction of the upward dislocation of the right pelvis at the sacroiliac joint and a probable reduction of the fractures of the left pelvis at the hip joint, (Fig. 2), and abduction of the hip obtained on the right side by such extension.

[*Concluded on p.* 185.]

NEW INSTRUMENTS

PORTABLE FRACTURE REDUCTION APPARATUS

COMBINING RECENT IMPROVEMENTS WITH BOEHLER'S PRINCIPLES

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LOUISVILLE, KY.

HAVING observed the fracture and traumatic work of Lorenz Boehler[1] in Vienna in 1928, it has been interesting to watch the development of various types of traction apparatus which owe their inception to the stimulus emmanating from the Boehler traction frames.

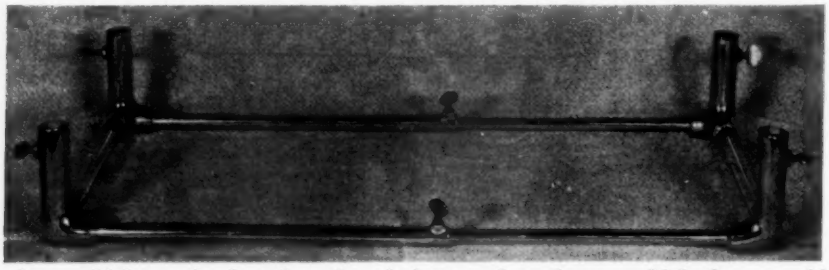

FIG. 1. Shows the base which can be lengthened and shortened, and upon which the rest of instrument can be set. Although this is of steel, it could be made of aluminum alloy.

Believing that the simplicity and adaptability of Boehler's frames have many advantages, the apparatus described represents an effort to combine the good points of later developments with those of Boehler's instruments. These are:

1. Tractors and counter tractors which allow controlled movement in all planes rather than only longitudinal skeletal traction and counter traction of the original Boehler frames.

2. The traction is directly in the long axis of the broken bone. Many of the instruments now popular have tractors which are perpendicular to the axis of the broken bone. Thus when longitudinal traction is exerted, the tractors tilt and are not efficient nor stabile.

3. It is possible to use one base and set of tractors to set up a frame for various types of traction, i.e. combining several instruments in one.

It is arranged especially for use in local and regional anesthesia, the Kirchner wire in skeletal traction, counter traction and incorporation of the wires in the non-padded plaster cast where desired. Figure 13 shows one variation of the Boehler frame as made by a manufacturer in this country.

The illustrations with explanatory notes show these features better than words. The type of traction used must be adapted to the case, many fractures being reducible by simple non-skeletal traction.

The advantages are that the surgeon has at his disposal a complete portable fracture traction table which can be easily transported, can be placed on a fluoroscopic table, can be completely sterilized in the autoclave and used at open operations and is inexpensive when compared to the cost of the large tables. It should be particularly useful in portable emergency hospital and army work. It is adaptable to

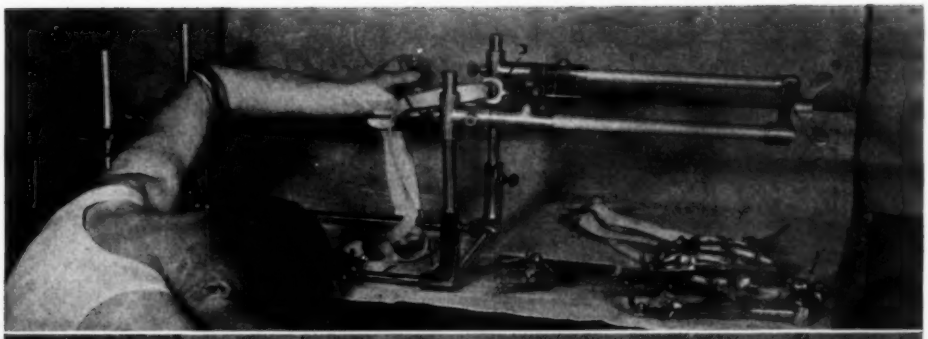

FIG. 2.

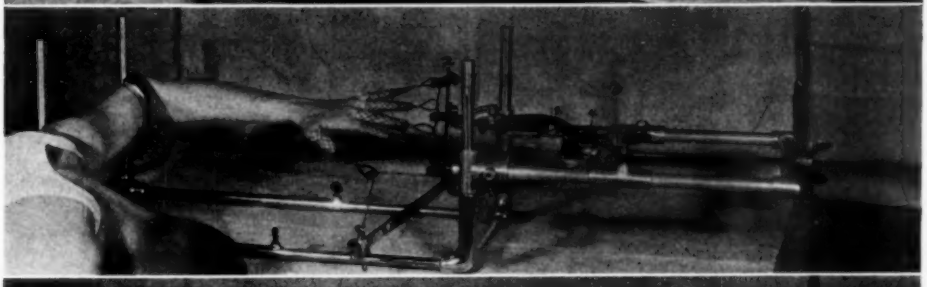

FIG. 3.

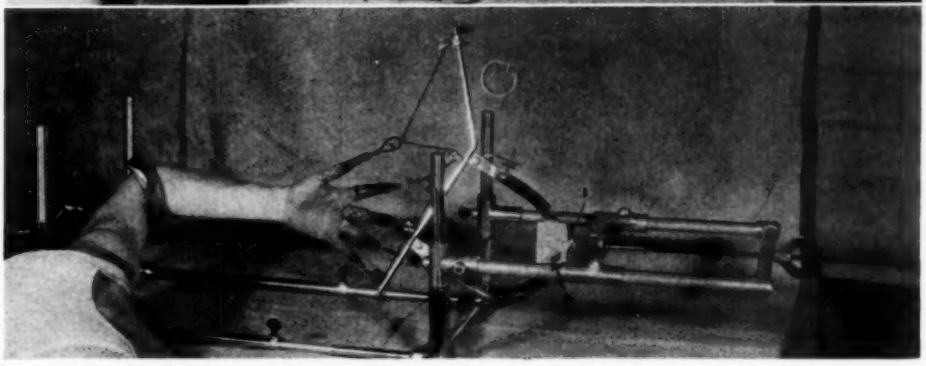

FIG. 4.

FIG. 2. Shows four aluminum posts upon which are mounted the traction screw apparatus and a crosspiece (1) to which is attached by a cone-clutch the aluminum hook (2) which holds the arm. This allows rotation of the hook if necessary. The cloth around the wrist is attached to the traction screw by means of a removable aluminum ring and cone-clutch (3). Traction is obtained by screw (4). (5) Shows male portion of cone-clutch with nut, which, when tightened by means of the key which fits into the holes in its side, holds the tractor firmly at the degree of rotation desired.

FIG. 3. (1) Tractor attached to the traction apparatus by means of a cone-clutch; (2) key used to tighten the cone clutch; (3) metal bar with finger traps attached to tractor; (4) screw which turns gear.

FIG. 4. Showing how cone-clutch (1) allows supination and how gear allows radial or ulnar deviation; (2) set-screw which prevents gear turning during traction. A different arrangement of the pulleys would be necessary to obtain best effect from radial or ulnar flexion.

FIG. 5.

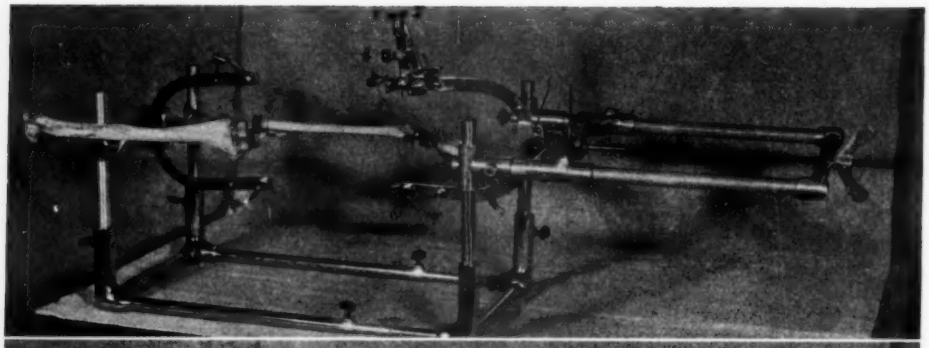

FIG. 6.

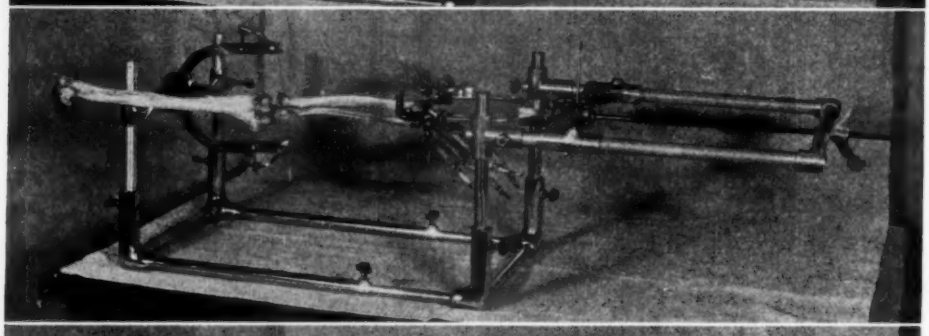

FIG. 7.

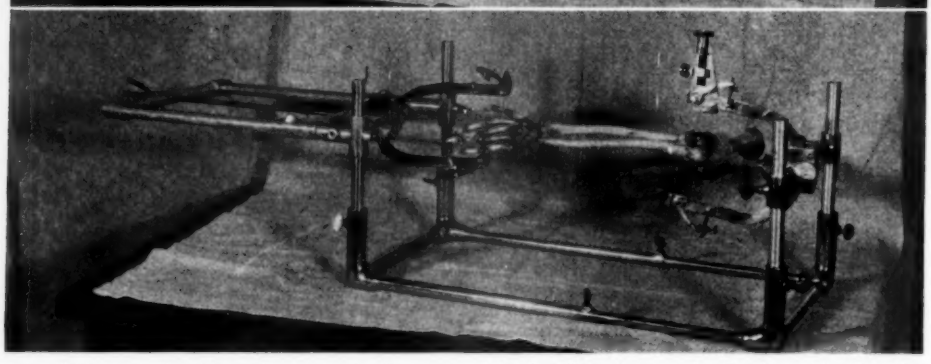

FIG. 5. (1) Tractor with cone-clutch and gear attachments; (2) the Kirschner wire is through the olecranon. If desired, this tractor or any Kirschner wire, or Steinmann pin tractor can simply be hooked over the cross piece instead of being attached by the cone-clutch. To attach this tractor as shown, the cross-piece has been reversed. (3) The metal bar and finger traps have been removed from tractor. The Kirschner wire is directed obliquely through the radius to avoid radial artery. (I have not used it thus, but plan to do so in a suitable case.) (4) The "tautner" has a flange which slips over the side of the tractor and is thus locked in place. The wire is attached by the "snubber" (a) and to the "tautner" by the "come along" (b). The thumb-screw (c) now causes the "come along" to move peripherally thus tightening the wire to any desired tension. The "snubber" (d) is then used to hold the wire taut, and the tautner removed.

FIG. 6. Shows the forearm supinated, (1) key used to tighten cone-clutch thereby preventing further rotation of tractor.

FIG. 7. Shows Kirschner wire through the metacarpals. This is useful in reduction of dislocated carpal bones. (1) Nut which prevents snubber from slipping if accidentally struck.

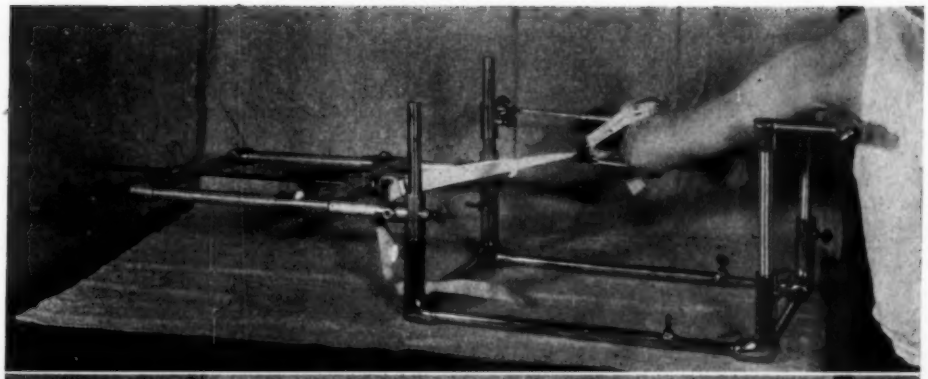

FIG. 8.

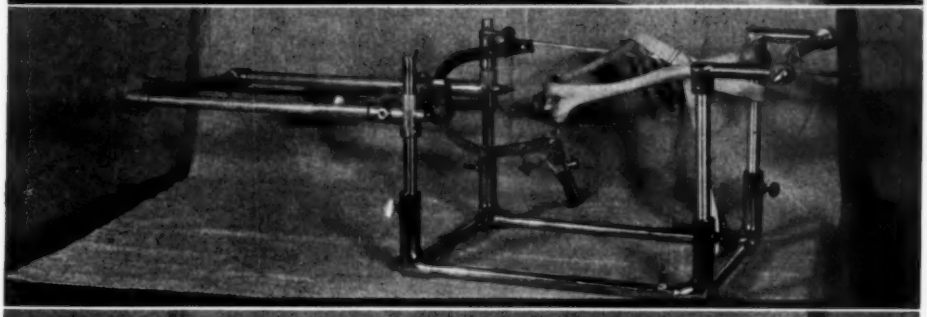

FIG. 9.

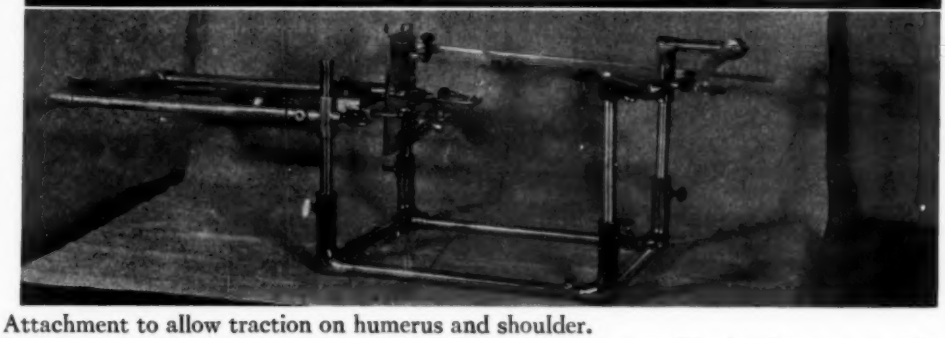

FIG. 10.

FIG. 8. Attachment to allow traction on humerus and shoulder.

FIG. 9. Same arranged for skeletal traction with wire through olecranon. The hand rests on an adjustable aluminum strip which stretches between the two far posts. This could be used with patient in recumbent position. This position is for reduction and application of plaster.

FIG. 10. Shows how the curved metal piece (a) can be freed from attachments on each side. If it should be incorporated in a cast it can be slipped out after the plaster has hardened. The foot rest (1) is placed here, merely to show how it fits on tractor.

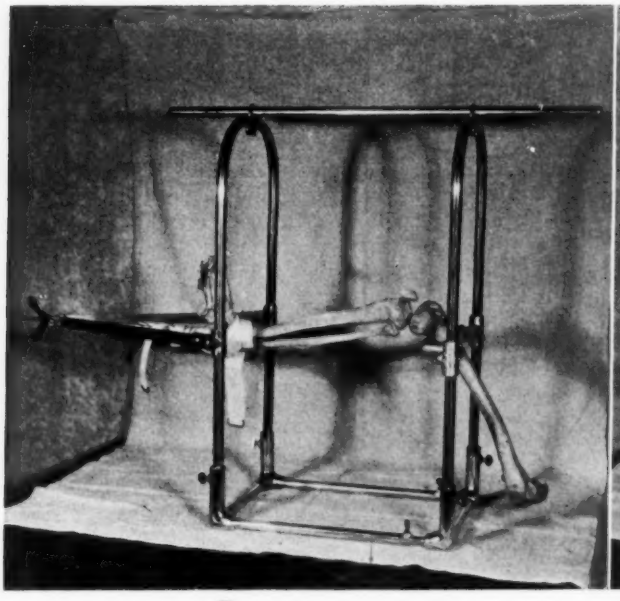

FIG. 11.

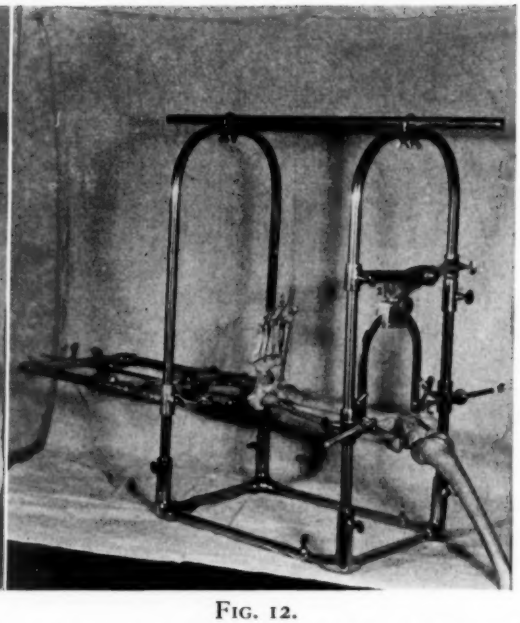

FIG. 12.

FIG. 11. The original Boehler principle of traction on lower leg with countertraction bar under knee, the cast being applied immediately and leg put on Braun frame. (Shown as made by an American company.)

FIG. 12. Arranged for skeletal traction with wires through tibial tubercle and os calcis. (1) An adaptor is attached by means of a cone-clutch to the cross piece previously shown. The tractor is attached by its cone-clutch to the adaptor. The universal joints on the screws (a) and (b) are fitted into the holes in tractor previously used to attach the finger traps. This makes the tractor rigid. In case it is desired to leave the patient in this position until maximum swelling has occurred, the leg can be suspended to prevent edema, by cloth strips from the longitudinal bar.

One wire is shown through the os calcis. It could be used to better advantage in most cases, through the lower end of tibia.

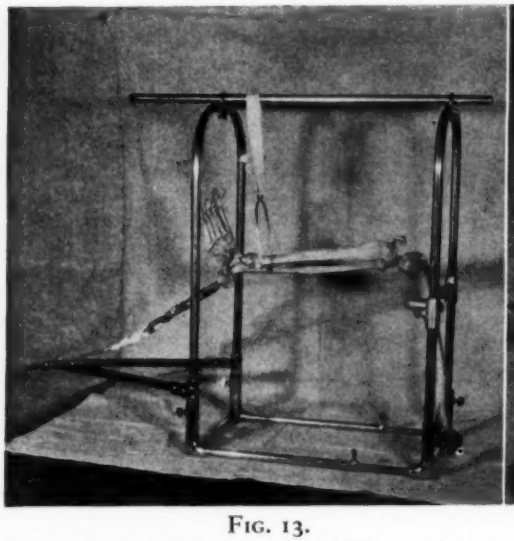

FIG. 13.

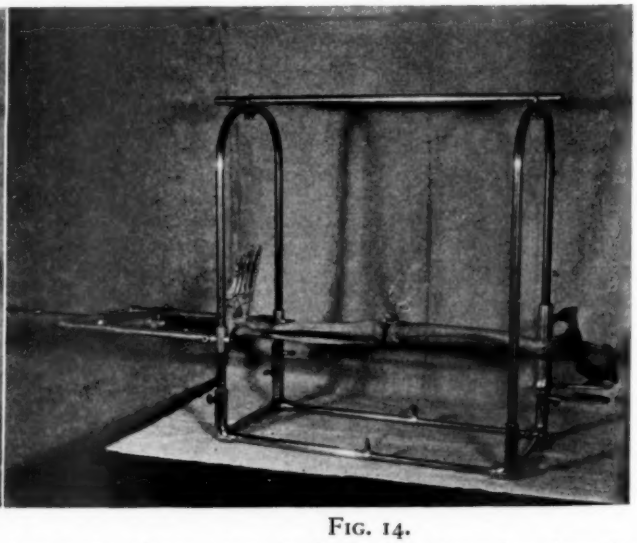

FIG. 14.

FIG. 13. In reduction of fracture of the os calcis, the pin should pass through the tibia and another through the os calcis; or ice tongs can be used on the latter. (Frame shown as made by an American company under Boehler's name.)

FIG. 14. Traction on whole leg or femur. The attachment for traction on the opposite leg is not shown. Boehler uses a somewhat similar arrangement and traction on both legs while inserting guide wires in neck of femur for use in the Johannson modification of the Smith-Petersen nail operation.

The clove hitch or similar method can be substituted for skeletal traction through tibia. The wire would usually be inserted through the lower end of tibia instead of os calcis as shown. (1) The pelvic rest simply slips over the upright (2).

In placing Kirschner wires in neck of femur as guides for the Smith-Petersen nail or bone graft, it is advantageous to have two *x*-ray units. This frame can be placed on *x*-ray table. A shock-proof portable can be used for the second unit.

inclusion of special ideas of individual surgeons.

The cone-clutch principle and the Caldwell finger traps[2] have been very helpful in designing this instrument.

The whole instrument is packed in a canvas roll which can be carried by one man. By making more of the parts of light alloys, the weight can be further reduced.

By placing the frame on end, it can be used for traction on the foot.

I am indebted to Wm. Watts for skilful machine work.

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CONCLUSION OF DR. ROSENBERG'S ARTICLE*

SUMMARY

Myxosarcoma of the prostate is of rare occurrence. The clinical diagnosis is frequently difficult due to the fact that most of these patients are seen late in the disease. Pelvic tumors of mesothelial origin may arise in the retrovesical tissue and bladder and the prostate become so completely invaded as to make the diagnosis of the primary site of the tumor impossible.

A case of myxosarcoma of the prostate in a white male age forty-six years, is reported. The patient was observed early in the disease when the pathological process was limited entirely to the prostate gland.

*Continued from p. 171.

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*Continued from p. 175.

CONCLUSION OF DR. STERN'S ARTICLE*

The patient had an uninterrupted recovery. When demonstrated in March, 1935, before the Mt. Sinai Medical Society he was walking unassisted without cane or crutch and did not complain of any of the usual painful symptoms described as due to lesions of the sacroiliac joint.

CONCLUSION

This case demonstrates the amount of pull-push upon the pelvis that can be exerted by the well leg traction apparatus, and secondly, that genuine lesions through the sacroiliac joint are not always followed by so called "sacroiliac symptoms."

*Continued from p. 179.

SUSPENSION FOR LEG CASTS

VOIGT MOONEY, M.D. F.A.C.S.

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THE application of a plaster-of-Paris leg cast for various affections of the knee joint brings up the question, "Will the cast stay in place and not slip down about the ankle when the patient is walking?"

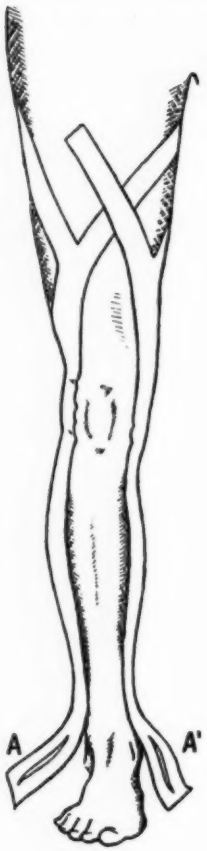

FIG. 1.

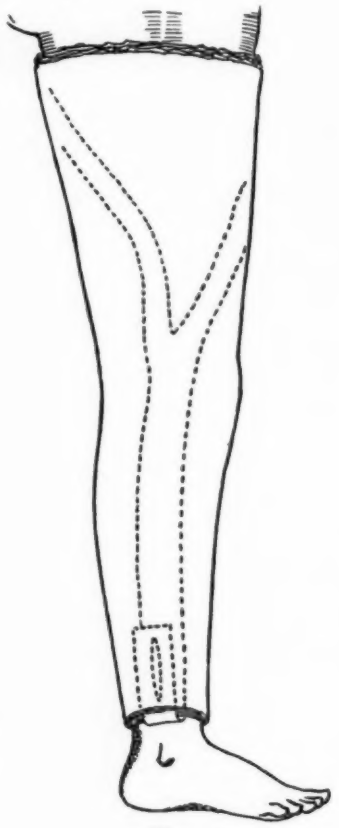

FIG. 2.

If the knee is flexed and the leg has a large calf and the cast is properly applied it will not slip. In obese individuals when the thigh and leg form a modified cone, some means of suspension is required to prevent the cast from slipping down about the ankle.

For several years I have successfully used the following method at the Allegheny General Hospital, Pittsburgh.

1. Adhesive (zinc oxide or mole skin) is applied to the affected leg as Fig. 1. Note the slits in the double thickness AA'.

2. Cotton sheet wadding about the leg and thigh is applied over the adhesive.

3. After the application of several layers of plaster-of-Paris bandage, the flaps A and A' are directed proximally and the plaster-of-Paris bandages are passed through the slits. The flaps A and A' are incorporated in the cast, Fig. 2.

Thus the cast is prevented from descending by a J-shaped piece of adhesive, the longer end being attached to the skin of the leg and the shorter end incorporated in the cast.

PROCTOSCOPE ADAPTER FOR OTOSCOPE BATTERY HANDLES*

WILLIAM LIEBERMAN, M.D.

BROOKLYN

THE instrument here described is intended to facilitate and encourage more frequent diagnostic rectal examinations under direct vision. This is done by a simple means of attaching proctoscopes and sigmoidoscopes to a battery handle such as is commonly used for otoscope and ophthalmoscope. The adapter which the writer devised for this purpose also eliminates the need for the wire connections, the transformer and the current outlet necessary when house current is used for illumination. It thus lends itself to convenient use in the patient's home.

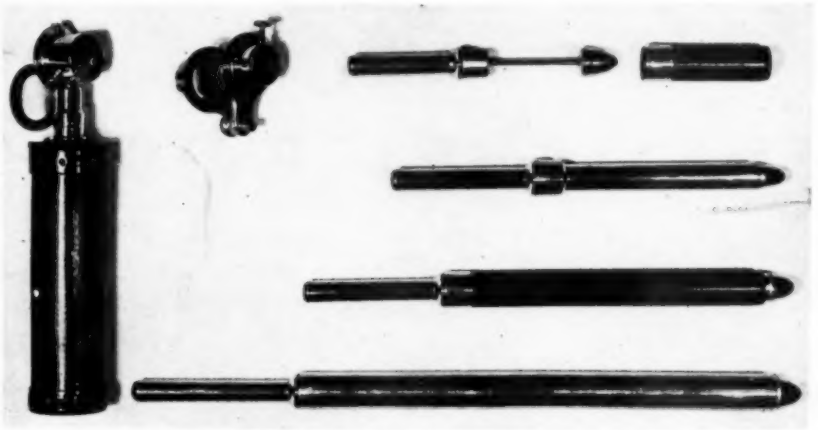

FIG. 1. Battery handle, adapter and various sizes of scopes.

The adapter (Fig. 1) consists of two collars joined at a pivot upon which they can be separated or swung into alignment. One collar fits into the light-bearing otoscope head, while into the other collar fit anoscopes, proctoscopes or sigmoidoscopes of various lengths and diameters both for adults and for infants.

The battery handle (Fig. 2) is grasped by the operator's hand and pressure applied on the obturator by the thumb of the same hand and the proctoscope is inserted into the rectum. The obturator is then withdrawn and the light-bearer is swung into place on the pivot to illuminate the interior of the rectum. The inside of the sigmoidoscope is gunmetaled to prevent back glare. The light is pivoted aside to permit the re-introduction of the obturator or the use of cotton tipped applicators for swabbing the mucosa without soiling or damaging the electric light bulb. All parts in contact with the patient, including the adapter, are sterilizable by boiling. With the window adjusted the rectum can be distended with air, if desired.

FIG. 2. Instrument ready for insertion into rectum.

SUMMARY

A simple adapter has been devised for attaching proctoscopes on an otoscope battery handle, thus facilitating rectal and sigmoid examinations with a minimum of manipulation and eliminating the need for wire connections and a transformer.

* From the Rectal Clinics, The Beth Moses Hospital, and The Jewish Hospital of Brooklyn.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

SPECULUM MATRICIS BY JAMES WOLVERIDGE

ONE OF THE RAREST BOOKS ON MIDWIFERY*

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INDIANAPOLIS, INDIANA

MANY a delightful volume has been written with the amenities of book collecting as its central theme. However, the author of that euphonious phrase, "The Amenities of Book-Collecting," rather derides the particular phase of the hobby which is most interesting to all of us. Newton in his essay "Old Catalogues and New Prices" says, "Some catalogues annoy me exceedingly: those which contain long lists of books that are not books; genealogies; county histories, obsolete medical and scientific books; books on agriculture and diseases of the horse." Be that as it may, to many of us the collection of such books is our chief delight, our golf and bridge rolled into one, a surcease from the daily grind, a diversion filled with many sore disappointments but with an occasional happy surprise.

The wealthy collector with an agent in every important center can fill his shelves as his fancy dictates, but to the amateur bibliophile no experience brings with it quite such a thrill as does the chance acquisition of a rare volume. Such an experience was mine about two years ago. An American nurse, long a resident in the Philippines, found in an old library a small volume on midwifery, to which she was attracted by its unusual frontispiece and by the quaintness of its text. She was about to return to the United States and, with no particular purpose in mind, put the book in her trunk. Learning of my interest in old medical works she presented it to me, with no notion of its origin or its rarity. Its very name was hitherto unknown to me and I never had heard of its author.

The book is titled, "Speculum Matricis, or the Expert Midwives Handmaid," written in 1669 by one James Wolveridge of Cork, Ireland and published in London in 1671. I found no mention of the book in any available reference works and appealed for aid to Dr. Alfred M. Hellman of New York. He also failed to find a reference and turned to Dr. Archibald Malloch for information. Through Dr. Malloch we learned of a somewhat extended discussion of the volume by Herbert R. Spencer, in the proceedings of the Royal

* Read before the Eleventh Annual Meeting of the American Association of The History of Medicine, Atlantic City, N. J., May 6, 1935.

Society of Medicine for May, 1927. Spencer calls "Speculum Matricis" one of the rarest books on midwifery, but Aveling has erroneously described it as the "Earliest original work on midwifery in the English language." There are, according to Spencer and Professor E. Essen-Möller of Lund, Sweden, only three known copies other than mine, one in the Royal College of Physicians of Edinburgh, one in the Radford Library, now the library of the Medical School of Manchester, and the third is possessed by the Royal College of Surgeons of London. The Edinburgh copy is in perfect state; that in the College of Surgeons has pages 144 and 145, and pages 159 to 166, in manuscript; the Manchester copy lacks the frontispiece. A magnificent manuscript copy, the work of Dr. John Lee Jardine, is in the Library of the Obstetrical Society of London. There is also an Irish edition of the book entitled, "Speculum Matricis Hybernicum, or the Irish Midwives Handmaid," and of this edition there are only two known copies, one in the Bodleian and one in the private library of Professor Essen-Möller.[1] The Irish book is identical with the English edition with the exception of changes on the title page.

My copy of this book is perfect as to text and plates except for a small portion torn from the lower edge of one plate. It is in contemporary calf, somewhat rubbed, and its size is 5¾ by 3⅞ inches. A few pages have been closely shaved. It contains twenty-three pages of introduction, twenty pages of index, eight pages of preface, and one hundred sixty-six pages of text. The book has a most unusual two-compartment frontispiece, and the text contains eight plates and twenty-one illustrations.

The introduction consists of a chapter entitled "The Author to the Reader." This is in a somewhat apologetic vein, asking the indulgence of the reader for the context and for the fact that the book is written in the vernacular rather than in Latin, but expressing the hope that the work "will be candidly received by all." This introductory paragraph is followed by a number of encomiums contributed by various friends of the author, some written in English and some in Latin verse, and concluding with an "achrostick" incorporating the author's full name.

The quaint text is, as the author says on his title page, "catechistically composed," and consists of a series of dialogues between one Dr. Philadelphos and a Mrs. Eutrapelia, the midwife. The questions and answers constitute the manner of instruction in obstetric practice. The book contains little that is original, and is made up largely of deliberate plagiarism from "The Expert Midwife," which was merely an English translation in 1637 of Rueff's "De Generatione Hominum" of 1580. The illustrations are from Rueff, who in turn had lifted them bodily from Rosslin's "Rosengarten" published in 1513. Spencer comments on this wholesale literary theft and quotes Thomas Fuller who, in 1662, wrote, "Such plagiary-ship ill becometh authors and printers; and the dove bearing the Crest of the Stationer's Armes should mind them not, like rooks, to filch copies from one another." It seems, however, that Fuller's words fell on deaf ears, as plagarism, thinly veiled, was exceedingly common then as now.

Little is known of the author, James Wolveridge, beyond the fact that he was an Englishman practicing in Ireland, the preface of the book being inscribed "From my study in Cork, Jan. 13, 1669." Herbert Spencer quotes Sir Charles Cameron who, in his history of the Royal College of Surgeons of Ireland, says of Wolveridge: "His name appears but with a question mark before it in Belcher's History of the Fraternity of Physicians, Trinity Hall, Dublin, established in 1660. I find the name James Wolveridge, M.D., 1664, in Dr. Todd's Roll of Graduates of the University of Dublin." The only references that I have been able to find to Wolveridge are the mere mention of his name and book in Watts' Bibliotheca Britannica and Haller's

[1] Irish Journal of Medical Science, sixth series, No. 78, June, 1932.

Bibliotheca Medicinae Practica, and his Bibliotheca Chirurgica. Neither the Army Medical Library nor the Library of the New York Academy of Medicine could give me further information.

The frontispiece of the "Speculum Matricis" is of unusual interest. It is divided horizontally into an upper and lower compartment. The upper contains a picture of the lying-in chamber, wherein the mother is in a canopied bed and the nurse, holding the babe swathed after the manner of the time, is seated before an open grate fire. The lower compartment represents the physician in powdered wig and velvet hat, addressing the pregnant woman and the midwife who holds a small book in her right hand and watches intently as the doctor addresses his patient. The woodcut is the work of Cross and according to Herbert Spencer, the identical picture also adorns the frontispiece of an anonymous work entitled "The English Midwife, Enlarged," published in London in 1682 by Rowland Reynolds, who was also the publisher of Wolveridge's work. My copy of Nicholas Culpepper's Pharmacopeia Londonensis, 1653, contains a portrait of Culpepper by the same artist, and this portrait so closely resembles that in Culpepper's Directory for Midwives, 1651, that I have no doubt it was the work of the same man, even though it is unsigned.

Not the least interesting detail of the book is a chronogram on the title page. A chronogram is defined by James Hilton, who has written an entire volume on the subject, as a "sentence or verse, wherein certain letters express a date, while the sentence itself is descriptive of or allusive to the event to which the date belongs."

The date itself is expressed by Roman numerals, these letters being distinguished from the others by being printed or carved in a larger size, so that they stand out as capital letters in the middle of a word. It is also necessary, in order that the chronogram be a perfect one, that every letter in the sentence which has a numerical equivalent must be employed. Chronograms are not common in secular literature, but are frequently found in religious works, especially those of the Catholic church. The Bibliotheca Osleriana contains the names of two medical works which are dated by the use of chronograms.

The chronogram on the title page of "Speculum Matricis" is as follows: "**IVX**ta **M**agna**LI**a **D**e**I** s**C**r**I**ptor (Juxta Magnalia Dei Scriptor)" which, loosely translated, is "Written by the Grace of God." It conforms to the rule for producing a perfect chronogram, which is to say that it employs all of the letters which have equivalents in Roman numerals. They total 1669, the year in which the book was written. Its inclusion was, no doubt, just a whim on the part of the author.

There is little about my "rara avis" to distinguish it from many another old medical treatise that was lost in limbo, because it had no particular educational or scientific value. Why, then, this presentation? Because there is connected with the book what the modern news hawk calls a human interest story, and I believe that it can best be told by quoting verbatim and at some length from the British Medical literature of half a century ago. The British Medical Journal for February 23, 1884, carried the following paragraph, under the heading, "A Lost Medical Work."

At the annual meeting of the Obstetrical Society of London, Dr. Aveling mentioned that the Society had some time since asked Dr. Fordyce Barker of New York, to have made for them a transcript of Wolveridge's "Speculum Matricis." This book, published in Dublin in 1670, is the earliest original work on midwifery in the English language, and the only copy known to exist was in the possession of Dr. Fordyce Barker who, at the request of the Society, employed a man to copy it. This person absconded with the volume, and died in Europe. Thus, it is feared, the only copy of this work has been irretrievably lost. It is asked that if any of our readers should meet with or hear of a copy of this rare book, they will inform the Honorary Librarian of the Obstetrical Society of London.

A week later, March 1, 1884, the same journal contained the following interesting article:

In reference to the loss of Wolveridge's Speculum Matricis, published in Dublin in 1670, and the earliest original work on midwifery written in the English language, we have learnt, since our article on the subject last week, the following particulars from Dr. Godson, who informs us that the person intrusted with the volume, for the purpose of copying it, has not been proved to have absconded with the volume. Dr. Fordyce Barker, in a letter to Dr. Godson, dated May 15, 1883, gives a full account of the transaction. Dr. Barker possessed a copy of the book in question, and about five years ago, at the request of the Obstetrical Society of London, took steps to find a man who could make a copy of it for the Society. Two American librarians referred Dr. Barker to a well-known and learned dealer in old books, named Sabine, now deceased. Mr. Sabine recommended an eccentric Frenchman, who lived in constant penury, but was a good copyist, much employed by collectors in New York, London, Paris, and Rome. This man, whose name was Emile Bouregeaud, undertook to copy the specimen of Speculum Matricis, which was at once lent to him for the purpose by Dr. Barker, who could not get him to fix on any sum to be paid for his services. Dr. Barker lost sight of Bourgeaud for a long time, but in April, 1881, he brought back the book, repaired with great skill, but only a part of the copy. Starvation had evidently prevented him from completing his task. Dr. Barker has never seen since then this poor copyist, who took away the book once more to complete the copy. He wrote once to Dr. Barker, saying that he had been invited to Brazil by the Emperor, in order to do some work for the Imperial Library, but hoped to be back in New York by November, 1881, with the book completely copied. Bourgeaud never returned the work. Dr. Barker communicated with the United States Legation at Rio de Janeiro, and was informed that Bourgeaud had really been at work in the Imperial Library, and he had never asked for any remuneration, though his work had given great satisfaction. A steerage-passenger in a steamer which sailed from Rio in November, 1881, was entered in the ship's list as "A. Boojo." Dr. Barker then discovered that the ship's cook, a Frenchman, named Quinquinet, had taken great interest in this passenger. On landing in New York, he took his unhappy countryman, who was in very bad health, to a low French tavern in Worcester Street. In May, 1883, Dr. Barker found out this tavern, and discovered from the landlady that the sick Frenchman had brought with him a box, and asked for ink, but used to sit still in his room doing nothing, and his reckoning was only once paid, and then by some friend, who took him and his trunk away. This is the last news that Dr. Barker could obtain about poor Emile Bourgeaud. It is very unlikely that he destroyed either the original book or his copy, and it is to be hoped that it was found in the box by the friend, if Bourgeaud really died soon after leaving the French tavern, as appeared to be highly probable. If the friend and the box could be traced, the ultimate fate of the book may yet be known. Possibly some of our readers may find the missing work on this or on the other side of the Atlantic.

Interest in the book did not abate. As late as November 17, 1888, the following note from James Blake Bailey appeared in the *Athenaeum*, under the heading "Wolveridge's 'Speculum Matricis:'"

I venture to send this note to the Athenaeum in the hope that it may elicit some information concerning the very scarce book above mentioned. The book in question is the first original work on midwifery in English. Dr. Fordyce Barker, of New York, had a copy which was supposed to be unique, and this he gave into the hands of the copyist so that a MS. copy might be made for the Obstetrical Society of London. The man, a Frenchman, named Bourgeaud, did not return the book, and probably did not finish the copy. After an interval of nearly five years Dr. Fordyce Barker traced Bourgeaud to a tavern in New York, and on inquiry found that he had died there and that his box had been removed by a friend. Since then nothing has been heard of this copy of the "Speculum." A note in the British Medical Journal drawing attention to this loss brought out the information that there were two other copies in existence, one in the Radford Library at St. Mary's Hospital, Manchester, and another the property of Mr. J. L. Jardine. This latter book, which has some of the pages supplied in MS. from the Man-

chester copy, was presented to the library of the Royal College of Surgeons by Mr. Jardine. The title of the book is "Speculum Matricis; or the Expert Midwives Handmaid. Catechistically composed, by James Wolveridge, M.D., with a copious alphabetical index, London, 1671.

On looking through the copy in the College of Surgeons' Library I was much puzzled by the following statement in the "Author to the Reader," as I could not find anything on the title-page to correspond with the "Irish Garb" to which the author refers:

'Though the Title-Page may arrive your view in an Irish Garb, with her Handmaid bare-foot, and bare-legg'd; or at the best, in Brogues and Kerchers, (according to the Custome of the Countrey), yet, be assured It hath an English dress under an Irish mantle; it being never intended for the Irish, (though I heartily wish it may be serviceable to them also, if occasion be,) whose fruitfulness is such, that there is scarce one barren among them. . . . '

On reference to the Bodleian catalogue I found the book entered as 'Speculum Matricis Hybernicum, or the Irish Midwives Handmaid, Lond., 1670'; and on examination of this copy it was readily seen that the book had been issued in 1670 with the title as in the Bodleian catalogue, and that in 1671 a new title had been printed, omitting all reference to "Hybernicum." So far as I can find the Bodleian copy is unique, unless Dr. Barker's copy be still in existence. This is said to have been published in Dublin in 1670, but in all probability it is the same edition as that in the Bodleian.

This, then, is the story of Speculum Matricis. What a wealth of speculation is conjured up by the tale. Is it the story of my book, or is it the story of Professor Essen-Möller's, or is there yet another copy, THE copy, resting perhaps in an unknown grave? There is nothing in the description of the lost volume to enable one to determine whether it is of the English or the Irish edition. The one mark in my copy which even remotely connects it with the eccentric French copyist is a small letter "B" which might be Bourgeaud's initial, and this is inscribed in an old hand and in faded ink upon the title page. Of course, this may be a mere coincidence, and I know of no way by which the identity could be positively established. If it be the lost work, how came it to the Philippines? Speculation is useless. The secret lies buried forever with poor old Bourgeaud.

SPECULUM
MATRICIS;
OR, THE
EXPERT MIDWIVES
HANDMAID.
Catechistically Composed,
BY
JAMES WOLVERIDGE,
M. D.
With a Copious Alphabetical Index.

WRITTEN
IVXta MagnaLIa DeI sCrIptor,
Anno Domini, { Chronogramma,
1669. { 1669.

Domus a quid non immittit dies?
Alias parentum, prior avis, tulit
Nos nequiores, mox daturos
Progeniem vitiosiorem.
Horat. Lib. 3. Carminum, Ode 6.

London, Printed by E. Okes; and are to be sold by Richard Royston, at the Kings-Arms in the Poultry, 1671.

BOOK REVIEWS

THE RADIOLOGY OF BONES AND JOINTS. By James F. Brailsford, M.D., M.R.C.S. (Eng.), Hunterian Professor, Royal College of Surgeons, England, 1934–5; Radiological Demonstrator in Living Anatomy, The University of Birmingham; Honorary Radiologist to Queen's Hospital, Royal Cripples' Hospital, Warwickshire Orthopedic Hospital, and Radiologist to St. Chad's Hospital and the City of Birmingham Infant Welfare Centres, Birmingham; Awarded the Robert Jones Gold Medal and Prize of the British Orthopedic Association, 1927. Second Edition, with 340 illustrations. Baltimore, William Wood & Company, 1935. Pp. 572. Price: $9.00.

The necessity for a reprinting of this work within a year of its initial publication is striking proof of the value of its contents, constituting eloquent testimonial to the appreciation given it by the medical profession. The reprinting afforded opportunity for including in the second edition supplementary findings of many researches conducted during the past year. The chapters dealing with Bone Dystrophies and Spondylolisthesis were re-written, and a chapter has been added on Dental Radiography. Some of the less satisfactory illustrations have been replaced by new and better ones, and a number of additional illustrations have been included. The index has been greatly amplified and improved.

Much could be written in praise of this excellent treatise. Apart from setting forth concisely an account of the bone changes seen in health and disease, the author has endeavored to indicate the significance of the radiological findings and further to present briefly the recent advances already recognized by radiologists and radiologic journals but not yet adequately appreciated by general text-books. The quality of the illustrations is good in spite of the increased difficulty of satisfactorily reproducing radiographic illustrations.

One criticism appeals to the American reader: while many references to the literature have been given, the list is by no means comprehensive. It could hardly be so without greatly expanding the book, but it seems to the reviewer that among the names chosen, some of the more important are conspicuous by their omission. For example, in listing pioneers in sinus radiology, Caldwell and Law are not mentioned. However, the author does not claim to offer an exhaustive bibliography. After all, this is a minor criticism of a splendid work.

RECENT ADVANCES IN CARDIOLOGY. By Terence East, M.A., D.M., F.R.C.P. and Curtis Bain, M.C., D.M., M.R.C.P. Third edition with 14 plates and 85 text-figures. Phila., P. Blakiston's Son & Co., Inc., 1936.

The surgeon who wishes to brush up on the subject of cardiology, and, also, be brought up to date can do no better than consider this monograph of 350 pages. That it is now offered in a Third Edition speaks well of its popularity and value.

The authors inform us that in this third edition they have rewritten the entire work aiming to impart the newest information.

The theme of the book is the importance of the health and efficiency of the heart muscle. Many subjects are considered; to enumerate a few: failure of the heart and its treatment, total ablation of the thyroid gland in heart failure, coronary thrombosis, auricular fibrillation and flutter, hypertension, hyperthyroidism, and radiology of the heart and great vessels. A large number of new electrocardiograms have been included.

The index is ample. A sufficient bibliography has been appended at the end of each chapter. We recommend this work to surgeons and general practitioners.

CLINICAL MISCELLANY. The Mary Imogene Basset Hospital. Vol. 2: 1935. Springfield, Ill., Charles C. Thomas.

As the title conveys, this volume consists of twenty articles by nine men on the staff of the Mary Imogene Basset Hospital. In the last paragraph of the preface, George M. Mackenzie writes, "The contributors to this volume of correlated clinical and laboratory observations would like to believe that they

are moving, even though slowly, along the path of integration."

Some of the titles, and all of them are interesting, are: Cholelithiasis and Cholecystitis in Childhood, Four Cases of Intussusception, Carcinoma of the Vulva, Primary Carcinoma of the Fallopian Tube, Some Remarks on the Treatment of Large Decubitus Ulcers, Six Years Experience with Acute Anterior Poliomyelitis in a Rural Community, Juvenile Acrodynia, Staphylococcus Aureus Bacteriemia possibly Associated with Undulant Fever, Fatal Hemorrhage from an Eroded Vessel in a Case of Scarlet Fever, Idiopathic Aplastic Anemia, Bacteriemia. The Results of 1283 Consecutive Blood Cultures in a Rural Hospital, etc.

The articles cover a wide range. They are well written and show that they are based on careful, painstaking work.

There is an index. It makes good reading for those interested in such subjects.

Disease and Destiny. By Ralph H. Major, M.D. Illustrated Preface by Logan Glendening, M.D. D. Appleton-Century Company, 1936.

If you are interested in history and give thought to the ills of mankind that have directly changed the course of human events, as well as the destinies of nations, then for sheer entertaining, as well as instructive reading, you will do well to get a copy of Dr. Major's latest book.

The author has painted his picture in ten chapters, each complete in itself and each, to the reviewer at least, is a gem. The subjects offered us are: The Black Death, Jail Fever, The King's Evil, Small-pox, Membranous Croup, The Pestilence That Walketh in Darkness, The Disease of Lazarus, Yellow Jack, The Legacy of Bleeding, and The Worst Picture of All.

In his foreword the author says that disease has played a dominant role in the destiny of the human race, destroyed old races, defeated armies, paralyzed trade, altered the economic life of nations, wiped out old castes and created new ones, and also has profoundly affected the lives of great leaders who have left their impress on history. At times Dr. Major surprises us, but he always intrigues us with his technique of telling us things we know.

It will not take you long to read this book, for, between times it will not be out of your hands until you turn the page and note the heading . . . "INDEX."

The Early Diagnosis of the Acute Abdomen. By Zachary Cope, B.A., M.D., M.S., F.R.C.S. Seventh Edition. London, Oxford University Press, 1935.

Aware that an early diagnosis in acute conditions of the abdomen is exceptional, the author felt that there was room for a small book dealing solely with the evaluation of the various puzzling symptoms present in urgent abdominal disease. This was in 1921. Two years later a second edition appeared and went through two printings. Editions followed in 1925, 1927, 1928, and 1932. This year this short but invaluable work is offered in a seventh edition.

The author in the first chapter considers "The Principles of Diagnosis in Acute Abdominal Disease." There are chapters on "Method of Diagnosis, Appendicitis and Differential Diagnosis, Perforation of a Gastric or Duodenal Ulcer, Acute Pancreatitis, Acute Intestinal Obstruction, Intussusception, Cancer of the Large Bowel, The Early Diagnosis of Strangulated and Obstructed Hernia, Acute Abdominal Symptoms in Pregnancy and the Puerperium, Ectopic Gestation, Cholecystitis, The Colics, The Early Diagnosis of Abdominal Injuries, The Acute Abdomen in the Tropics, Acute Abdominal Disease with Genito-Urinary Symptoms, The Diagnosis of Acute Peritonitis, and Diseases which may Simulate the Acute Abdomen." There is an ample index and thirty-three illustrations.

The author says that in the seventh edition he has made several small alterations in the text and that the chief additions have been paragraphs showing the help which may sometimes be obtained from *x*-rays in the diagnosis of intestinal obstruction. It is a valuable and practical work.

Note

In reviewing Puerperal Gynecology in the December, 1935, issue, the author's name was misspelled. It should be J. L. Bubis.